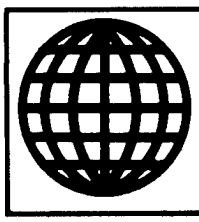
JPRS-EST-89-022
17 JULY 1989



JPRS Report

Science & Technology

Europe

Science & Technology
Europe

JPRS-EST-89-022

CONTENTS

17 JULY 1989

SCIENCE & TECHNOLOGY POLICY

SUPERCONDUCTIVITY

EAST EUROPE

BIOTECHNOLOGY

COMPUTERS

FACTORY AUTOMATION, ROBOTICS

TELECOMMUNICATIONS R&D

ADVANCED MATERIALS

Italy: New Consortium for Composite Materials Established

MI890254 Milan ITALIA OGGI in Italian
22-23 Apr 89 p 19

[Article by Manlio Pisu: "Consortium for Composite Materials"]

[Text] Italian industry has set up a research consortium to concentrate its efforts in the study of composite materials. The members of the consortium include Aeritalia, Agusta, Lamitel (an Enichem-Olivetti joint venture for the production of electronic laminates), and Italcomposti (an Enichem-Agusta joint venture for the production of preimpregnated materials for the transport industry). The research center, which will be located somewhere between Fiuggi and Anagni, will benefit from the incentives provided for under Law No 64, and is expected to be operational within 2 years.

The establishment of the consortium, which took place on 6 April, was announced at a press conference held by Fausto Cereti, chairman of the newly-created Composite Research Consortium, and vice president and managing director of Aeritalia. "Italy's technologically most advanced companies, which are also most aware of the necessity for development in the high-technology sector, felt the need to join their efforts in confronting the world challenge with some probability of success," Cereti stated. The initiative gained the support of the country's leading industrial groups, both in the public and private sectors. The only notable exception is FIAT which, for the time being, "has excluded itself," observed Valter Pasqua, president of Italcompositi and Lamitel.

"The objective of the consortium," Cereti explained, "is to concentrate the research activities of the four companies by coordinating the work that each has carried out to date in its own laboratory." This cooperation may be extended to foreign partners in the future, but before then, Cereti stated, "we must be able to offer goods in exchange, that is, specific know-how." The research center aims at becoming a "point of technological excellence" in Italy. It will be staffed by approximately twenty scientists, including, as Cereti observed, a couple of Nobel prize candidates.

Composite materials are an important part of the forthcoming technological challenge. They are innovative materials, constructed with a basic matrix and internal reinforcement elements, and offer a combination of very high resistance, flexibility, and lightness. The materials range from the simplest (such as glass fiber-reinforced plastic and carbon fiber) to the most sophisticated, currently used in the aircraft, space, automobile, and electronics industries. The sector is expanding rapidly: "applications and sales volume double every 2 or 3 years," Cereti stated. At present, Italy produces between 200 and 300 tons each year (at a cost of approximately 200 million lire per ton), but production figures may soar if new applications are found. "The oil industry alone could absorb 30,000 tons a year, providing suitable applications for these new materials are found on offshore platforms," observed Raffaele Santoro, vice president and managing director of AGIP [Italian National Oil Company]. "The use of composites," he added, "may result in a 50 percent reduction in the weight of platform structures, reducing costs accordingly."

Belgian Firm Develops Unbreakable Chemical Polymer

36980231 Brussels KNACK in Dutch
26 Apr 89 pp 191-194

[Report on interview with Professors Patfoort and Wastiels of the Free University of Brussels by Lode Willems: "Clay Is Stronger than Concrete"; first paragraph is KNACK introduction]

[Text] Minerals such as clay can become harder than concrete, but also tougher and thus unbreakable. That is due to a chemical polymerization process for which the VUB [Free University of Brussels] Structural Engineering Laboratory holds the secret.

Things are looking up. Perhaps the energy problem is being solved thanks to nuclear fusion. And whatever happens, construction procedures are turning up which will be much less of a burden to our environment and our savings account. For currently we are still consuming a great deal of energy in order to make all kinds of things. Forty percent of our energy consumption goes to industrial products. But recently the future has been looking better. And the future belongs to Mips, the mineral polymers. The raw materials for these occur everywhere in abundance. And to manufacture construction material from them does not require a tough and expensive work method; it succeeds at normal atmospheric pressure and the temperature of a cooking fire, potentially achievable with solar energy. Thus it can be made inexpensively and in an environment-friendly manner from a basic material available everywhere. Only, one must know how. And that is not such a simple matter, not even for someone who might steal the formulas to try to duplicate it himself. For that know-how is the fruit of 10 years of intensive research and a little bit of good luck.

What can one make with mineral polymers, with Mips? Mips can be applied in buildings and vehicle bodies, in advanced technological and mechanical constructions for machines, and yes, also in art work. You can sculpt with it; you can do anything with it that you do with clay, anything you do with concrete and anything you do or make with metal or plastic. Knead, cut, cast, press....

It is rather a lot to review at one time, and even the inventors are not yet capable of summing up all at once all current and future possibilities. After all, this material did not exist until recently.

Cement and reinforced concrete are not acid rain- and corrosion-proof. A stone building is not even earthquake resistant. And all materials we have been making up till now are more or less taxing to the environment and expensive. What we need (needed?) are construction materials (for buildings and numerous other structures) with the following characteristics: low density, fire-proof (must not burst into flame, melt, or evaporate), resistant to chemical products and high temperatures, thus materials which are tough, not brittle, not breakable, and which can be manufactured with a low energy input and therefore also inexpensively, which are available in inexhaustible quantities and which are, if at all possible, ecologically attractive.

What is inexhaustible on earth? The earth's crust is composed of 46 percent oxygen, 27 percent silicon and 7 percent aluminum (for comparison: the earth's crust contains 0.0008 percent nickel, 0.008 percent copper and 0.00001 percent silver). And fortunately these three most-frequently occurring elements are also more or less evenly spread over the entire earth, being found in rock, clay and sand. For that matter, we have been using them since olden times in bricks and ceramics, and more recently for cement and porcelain. Until now, however, each production process with these elements was rather energy-wasting. But if you know how, they are polymerizable at normal atmospheric pressure and at temperatures between room temperature and a maximum of 100 degrees Celsius.

Building and modelling with clay, that is, in simple terms, what they are doing at the VUB. With clay, as our ancestors did. But in a very different manner. A Mip structure is three times as strong as a normal concrete structure. The bending resistance is double that of concrete. And to make mineral polymers, you need only one tenth of the energy required to make cement.

"The question is not how strong it is," says Professor Patfoort, "the question is: how do you destroy it? You cannot cut it with either torches or by drilling."

A chemical engineer with a special license in technology, George Patfoort is project coordinator at Unido, the organization of the United Nations for industrial development, and honorary lecturer at the Free University of Brussels. Together with Professor Jan Wastiels, he is one of the key figures in this project in which about 15 people work. Structural Engineer Jan Wastiels is a VUB lecturer and head of the Structural Engineering Laboratory. In the Department of Structural Engineering of the Free University of Brussels research is being done right now in two completely different areas:

—Inexpensive building materials with an emphasis on characteristics such as inflammability, low energy input and toughness, along with earthquake resistance. Patfoort: "In earthquakes, collapsing buildings cause most of the victims. People are hit by stones, pieces of walls and roofs, and pieces of glass. Thus we need a flexible building material which bends and warps rather than breaks or bursts."

—Materials for advanced technology, with an emphasis on strength, toughness and great heat resistance.

"In a project such as this, various disciplines are needed," says Professor Wastiels. "You need knowledge of materials, geology (to find appropriate earth), mineralogy, chemical engineering, processing, construction knowledge, designing, architecture, structural engineering. Little by little we have developed a team here, the Earth Technology Institute (ETI), established in 1985 by Professor Roland Paepe. The task of that institute is the programming, planning and carrying out of projects in industrialized as well as in developing countries. Projects in the area of R&D, the realizing of prototypes, pilot projects, theoretical and applied sciences and related areas in which an interdisciplinary approach is desired. The Earth in ETI has a double meaning: earth is the source of all raw materials, and earth is also the living environment, a crossroads of technological and ecological systems."

Because upon entering the Structural Engineering Laboratory, we right away were invited to touch a Mip stone, we thought they had discovered a new building material there. That is indeed the case, amongst other things, but there is more to it. The female figure on a bas-relief in the entrance hall—a work of art by Roland Lefevre—is also cast from Mip.

Wastiels: Building material? Call it a structure. That is more general. The label building material is too restrictive for what we make. As to the applications, we need not limit ourselves to building alone. A structure in general, that might be a mechanical structure in machines, or in buildings, yes. That may have various aspects. It can also be a work of art.

[Question] And furniture? Body work for vehicles? Aircraft bodies? Space stations?

Wastiels: A priori, why not? Sure that is possible.

Patfoort: It is a possibility, but we don't know ourselves yet what possibilities are open to us.

[Question] How do you manufacture these mineral polymers? With what tools and what material?

Patfoort: With clay. Not just any clay, but anyway, we take clay and break up its original structure. We remove the oxides from it, various oxides which we then link together again in a different manner.

[Question] Thus you start mixing. How?

Patfoort: We mix it by putting it into an alkaline environment. We heat that up a little, and then it starts to polymerize. And you can mix more or less water into it, so that the viscosity becomes higher or lower. In principle we can work according to three different procedures. In the first one we work so dry that we are dealing with a more or less dry powder. And then you can press hard on that, and at a certain temperature it starts to polymerize. Thus you get a block as a result. The second system: you work from a type of paste. And with it you can model, extrude (pressure die casting) and press. In the third system we work with a liquid.

Wastiels: The advantage of a casting system is that it is easy to make composites with it, that you can introduce reinforcements in it, that, for example, you can mix in all types of fillers to modify the characteristics after hardening. But also in a paste you can mix fibers, for example in strengthening concrete cast floors with steel fibers. In this case the possibilities are limited, however. With a liquid system, on the other hand, you can make composites with a continuous fiber reinforcement, as is done in polyester or epoxy. One of the advantages of being able to work with materials which can be cast is that you don't get brittleness, as in the ceramic materials class. That brittleness cannot be avoided even with materials such as cement. One cannot make a tough material of that.

[Question] Isn't reinforced concrete tough?

Wastiels: Yes, but you cannot make reinforced concrete of one centimeter thickness. For that you need much finer fibers. And those can only be blended in if you can work with a liquid.

Patfoort (shows a sadly misshapen Mipstone): This is pliable stone. We have tried to destroy it with all sorts of rough means. But it doesn't break, it doesn't crumble. It bends.

Question: Might you also have an example of the inflammability?

Wastiels (takes a Mipstone which shows glazed bumps along one side): If you put the material under high temperature, all you get is a glazing. We fired an acetylene burner at this stone for one minute. An acetylene burner with a large output which can go to a temperature of 2000 degrees. And as you see, that one side is glazed. And at that, you were able to put your hand on the other side without being burned. What we actually have here is a combination of the fireproof characteristics of ceramic materials, but with the toughness you get with fiber reinforcement.

Patfoort: But don't misunderstand us, we are not involved in making neo-ceramic materials here. For neo-ceramics are all made at high temperatures and they are extremely expensive.

Wastiels: We are thinking of processing waste materials into it also. Even radioactive waste.

[Question] I assume that during production you can also choose the weight of the material.

Wastiels: If you blend lighter fillers into it, then you will indeed get a lower density.

[Question] You showed me that stone. One could cement such stones together. But that is cumbersome manner of working. If you have such technology available, wouldn't it be much simpler to manufacture living modules in one piece right away?

Patfoort: That is precisely what we have in mind. For you cannot make earthquake resistant buildings with bricks, for example. And we are involved in a project for earthquake resistant buildings. The material bends under pressure, and it is the deformation which absorbs the energy. One doesn't get stones or shingles on one's head.

[Question] Thus you have projects abroad?

Patfoort: Currently we are working with China, Peru and Ghana. And we are setting up something with Suriname. Those are projects for inexpensive building materials in developing countries. Our technology-directed projects are running in Europe itself.

[Question] Where in Europe?

Wastiels: We are not able to reveal that for the time being. Because matters have not been completed yet and also because we are bound to confidentiality. But with respect to the technological aspect, there are quite a number of projects in various areas. One year from now we can speak of industrial development.

[Question] Have you taken out patents on this important discovery?

Patfoort: Our research is still continuing and our formulations look a little different every week. That cannot be patented. And it is not purely a matter of formulation. We found some similar formulations from 1980. The difference is that at that time no one thought of making a structure, a construction, with it.

[Question] Then how do you protect yourself against pirates?

Wastiels: The procedure is fairly complicated. It contains considerable know-how. And that is not so easy to copy. Not even if we explain exactly how it is done. One would still be bungling and stumbling terribly.

AEROSPACE, CIVIL AVIATION

FRG's BASF Directs Composites Research to Aerospace Applications

36980233b Stuttgart FLUG REVUE in German April 89 pp 66-68

[Article by Erwin Heitz: "Molecules Instead of Fibers"; first paragraph is FLUG REVUE introduction]

[Text] Macromolecules systematically embedded in the matrix are reported to further improve the properties of composites. BASF is performing expensive research.

Through reinforcement with oriented glass, carbon, or aramid fibers, composites attain strengths equal to those of metals. The most recent calculations lead to the conclusion that the properties achieved to date can still be surpassed using new processes. A research project for this is underway with support from the Federal Ministry for Research and Technology (BMFT). Its objective is expressed as follows: "An attempt is being made to produce high performance polymer materials through molecular reinforcement." They are distinguished from earlier composites by their structure. Instead of reinforcement using fibrous tissue in various directions, rigid-chain macromolecules are to be used in small but precisely defined proportions. They are to be positioned as so-called "macromolecular reinforcement."

Aerospace is one of the fields of application for high performance composites. Anyone who wants to prevail in this market needs efficient, product-oriented research and the latest technology and production centers. Three years ago, BASF took over the American company Celanese's prepreg and development research division including carbon fiber activities and thus entered this promising sector. BASF considers Europe with annual sales of approximately DM220 million and a world market share of approximately 20 percent as the second largest market for composites, behind the United States. Expert observers of the sector predict a continued growth rate of from 15 to 20 percent for the coming years. Aerospace alone will have a 70-percent share of that.

Consequently, BASF is currently working on the composites specifications needed to gain access to the most significant European and American programs. At present, the company is working with MBB, Dornier, MAN, and MTU in Germany; with Aerospatiale and Dassault in France; with Aeritalia, Agusta, Aermacchi, and SIAI Marchetti in Italy; with British Aerospace, Short Brothers, and Westland in the United Kingdom; with CASA in Spain; and with Fokker in the Netherlands to qualify new composite materials for aerospace projects. Of course, BASF also has an eye on the Airbus program.

In America, BASF is already one of the leading carbon-fiber composite suppliers, along with Hercules and Amoco. In the Beechcraft Starship, the fuselage was developed using resin-impregnated Celion carbon fibers. They are produced mostly from PAN as the starting material in a wet-spinning process. A melt-spinning process promises advantages for future production. That would make it possible to produce carbon fibers of varying dimensions. It also appears to be somewhat more cost effective. BASF intends to equip itself at its own expense for the high performance composite sector through immense outlays. During the next 5 years alone, several hundred million [DM] are to be invested in research and the facilities required. Basic research and continued development of the resin, the support material for the composites, is being performed at Narmco in Ludwigshafen, Germany. The objective there is to develop duroplast resins which have improved toughness without compromising other properties. Also in progress are fundamental investigations on optimizing fiber surface treatment to improve the matrix-to-fiber bond upon which the mechanical properties of composites are heavily dependent.

Also of interest are new developments for applications of composites in the high temperature range. Here, thermoplast prepregs with application-specific properties are being sought.

Batelle CEO on FRG Aerospace Programs

36980230a MunichINDUSTRIEMAGAZIN in German May 89 pp 102-107

[Interview with Dr Helmut Rabenhorst, CEO of Frankfurt's Battelle Institute; correspondent, date, and place not given: "Right or Not at All"; first paragraph is INDUSTRIEMAGAZIN introduction]

[Text] INDUSTRIEMAGAZIN spoke with Dr Helmut Rabenhorst, CEO of Frankfurt's Battelle Institute on the outlook for the future of German space flight after the initial green light for the Saenger project.

INDUSTRIEMAGAZIN: Dr Rabenhorst, 2 months ago Federal Research Minister Heinz Riesenhuber took another step in the billion DM manned space flight adventure. By 1992 a consortium of German firms is supposed to develop the design for a fully reusable space transport plane called Saenger which will be able to take off and land at any large airport. Do we really need manned space flight; is it not an anachronism in the age of automation?

Rabenhorst: In principle, one could say that everything can be automated, even experiments in microgravity in earth orbit. The disadvantage is that it is difficult to intervene if something unforeseen happens, for example, to make immediate repairs. I can hardly imagine any reasonable experiment without human intervention from time to time. And since astronauts continue to make themselves available willingly with full knowledge

of the risks, it should be carried out without undue concern. For the long term, I do not believe that there will be much further unmanned development.

INDUSTRIEMAGAZIN: In this connection are you thinking about metallurgical and biochemical production under microgravity?

Rabenhorst: No, I believe that for economic reasons, intercontinental transport through near-space will come first—in 20, 25, 30 years. And at that time there will be such traffic up there that humans will probably be needed for maneuvering.

INDUSTRIEMAGAZIN: Why do you expect production in space to come later?

Rabenhorst: Microgravity experiments are still only in the pure research stage. If anyone were intending to produce anything in the manned laboratory Castor planned by the Europeans for docking on the Columbus space station or in the free-flying platform Pollux, which would be more suitable for that, preparations would have to be well underway.

INDUSTRIEMAGAZIN: But there is no lack of attempts to encourage industry to use the space laboratory.

Rabenhorst: There is, however, a lack of response. Two very recent Batelle Institute studies in which those affected were directly addressed showed that industry is shying away from the long schedules and the risks and also has no concrete industrial and commercial plans for space. These ideas would have to come from pure research. And the German microgravity program has made hardly any progress in this regard.

INDUSTRIEMAGAZIN: That is surprising, since the FRG is said to be ahead of the United States in this area.

Rabenhorst: That is in fact true, scientifically speaking. But this is also where the disadvantage lies. German space experiments are very scientifically planned right down to the last detail, which in turn runs the costs up. Rapid screening programs where, depending on the type of industry, a large group of materials could be thoroughly tested for certain effects as cost-effectively as possible are frowned upon. In this, the Japanese and the Americans are less plagued by scruples and could possibly soon pass us by.

But, however the research race comes out, there is still no agreement on whether it would be worthwhile one day to manufacture under microgravity in earth orbit or whether the processes for manufacturing on earth will be improved with the knowledge gained. I see greater uncertainty there than in the possibility of one day transporting goods or people with a space plane such as Saenger.

INDUSTRIEMAGAZIN: You really believe that this will one day be the case with all the technical problems—from safe hydrogen propulsion to materials which can withstand reentry in continuous operation?

Rabenhorst: When I consider the expense already borne today for intercontinental transport of express goods by air, I would imagine that this could one day be handled much better with Saenger. Take an example from today: Fifteen or 20 years ago no one would have dreamed that it would be profitable to fly flowers from the Canary Islands to Frankfurt. And, when you consider that today's planes contribute to atmospheric pollution, a hydrogen-powered space plane like Saenger is much less harmful environmentally.

INDUSTRIEMAGAZIN: Assuming that it is economically feasible to operate the plane. Even among the experts there are skeptics.

Rabenhorst: But, to arrive at a correct judgment, you must conduct R&D step by step in this area. If we Europeans do not do it, others certainly will. The Americans are pursuing similar plans. And when the commercial breakthrough comes, it will be too late for us to start.

The determining factor is however that we are in technological competition with the others. Since the Europeans have decided in favor of space flight, the only choice remaining for the FRG is either to do it right or not to participate at all.

INDUSTRIEMAGAZIN: All right, let's assume that Saenger is necessary. Do the Europeans still first need the Hermes space glider which merely imitates today's U.S. shuttles?

Rabenhorst: In my opinion, it would be difficult for us to do without Hermes for two reasons. First, in manned space flight the Europeans have thus far had to rely on others, i.e., the United States and the Soviet Union. The difficulties that causes us can be seen now in the aftermath of the Challenger accident; we still will not have our turn soon. And, second, we should not be so presumptuous as to think that we can create Saenger without any experience. The Europeans still have a technology deficit in this connection.

INDUSTRIEMAGAZIN: How so?

Rabenhorst: I am using the word technology in the strict German sense: Knowledge about techniques. In this vein, the Europeans still have a great need to first understand the techniques of reusable space transporters, for example, the problems of reentry. Therefore, there must be a preliminary stage such as Hermes to gain adequate experience in such critical areas as engines, heat resistant materials, and aerodynamics, and not just in the development phase which is now beginning, but also in later operation.

INDUSTRIEMAGAZIN: France is the project leader for Hermes and Ariane V which is to place the space shuttle in orbit, and France is also developing the key technological components. In contrast, Saenger is a German initiative. Do you think the French are willing to let the Germans be the stars of the next generation?

Rabenhorst: Without their willingness it will not happen. After all, Hermes is now a European Community project, albeit under French leadership. However, I believe the responsible German partner is clever enough to protect himself in the handling of his share of the know-how. Furthermore, such a large project can only be carried out jointly. Accordingly, the benefits must be fairly distributed. And, anyway, Saenger can only be implemented as a European project, even under German leadership.

INDUSTRIEMAGAZIN: What will happen to the British hypersonic project Hotol? Europe cannot afford two developments.

Rabenhorst: With this question we enter an area of wild speculation. I believe that all those outside the three large projects Hermes, Ariane V, and the Columbus modules are involved in a little muscle flexing and are staking out their claims. But when it really gets down to construction and the calculations are made about the cost of the whole business, then things will quickly move in a single direction. It costs so much money that it is my opinion that it can only go forward with a coordinated European base. If we do not cure ourselves of the habit of nursing national egoisms and petty rivalries, we will all go down with the ship.

INDUSTRIEMAGAZIN: The three ESA manned space flight projects adopted, then Saenger—can all this be financed?

Rabenhorst: It is dizzying just to hear what is being spent for the three projects already firmly agreed to. It takes so much money that it cannot continue this way. Because it is hardly conceivable that all other budgets will be frozen and the growth will all go into space. It is really pointless to speculate on the costs of Saenger which will fall primarily in the 21st century.

INDUSTRIEMAGAZIN: And where could money be saved in the nineties of this century?

Rabenhorst: You would have to ask the politicians who first collect the money and then distribute it.

INDUSTRIEMAGAZIN: Batelle Institute has however made a recommendation. On the condition that Saenger be implemented, the preliminary steps of Hermes along with its booster Ariane V, which could also provide income in the satellite transport market, are necessary. Consequently, you argue in favor of doing away with the free-flying laboratory module Pollux within the framework of the Columbus space station program.

Rabenhorst: Yes, since we believe that the manned laboratory Castor connected with the U.S. space station is adequate for materials research in microgravity—if expensive space experiments are reserved for those problems where all available possibilities on earth have been exhausted. At any rate, it would be essential to invest more money in the preliminary programs, and especially in the industrial flight opportunities for preliminary experiments such as free-fall motion of aircraft or the use of deep mine shafts.

INDUSTRIEMAGAZIN: And, all in all, that would be less expensive?

Rabenhorst: I am relatively certain of that. Remember that, according to the experience with Spacelab, outfitting an instrument for use in space costs 50 to 100 times the normal price.

INDUSTRIEMAGAZIN: Are there any other possibilities for savings?

Rabenhorst: Absolutely. Our recommendation, which we stand behind because we consider it reasonable, should be chiefly food for thought about possibilities for savings—precisely by concentrating manned space flight on what only it can do. When there is too little money, priorities must be established. But, if you ask 20 experts in the FRG what those priorities should be, you will get 25 answers—depending on their professional or economic interests. In this respect, even we are biased.

INDUSTRIEMAGAZIN: In the end, however, a definite choice must be made.

Rabenhorst: True. But that is the job of the politicians who control spending. And, above all, the planned German Space Agency (DARA) should have this responsibility.

INDUSTRIEMAGAZIN: But why is DARA still necessary? We already have the Federal Ministry of Research [BMFT] and its subordinate the German Aviation and Space Institute (DLR) as the so-called "project agency."

Rabenhorst: This distribution of responsibilities has, however, not functioned as well as it should. The DLR has an extremely technical orientation, and the BMFT controls the money. In this area of tensions, industrial outsiders have had difficulty participating in space projects. The whole business has remained a "closed shop" dominated by a few large firms. DARA should combine financial and technical responsibility so that the left hand knows what the right hand can spend and vice versa. It should also do a better job of involving the private sector and balancing scientific and industrial interests.

INDUSTRIEMAGAZIN: Meanwhile, it seems that DARA's job will be not so much to restrain the dominance of the scientific orientation as the economic supremacy of the aerospace firm Daimler & Co.

Rabenhorst: That is certainly another reason we need a strong DARA. Based on all experience in other countries, the negative effect of the lack of competition in a situation like Daimler's outweighs the potential for rationalization in consolidation, such as avoidance of duplicate development. And one of the most important possibilities for savings in the space budget is to simply say: "We are prepared to spend only a certain amount and no more for the desired system." That works for NASA, DARA's model.

INDUSTRIEMAGAZIN: If, however, as you say, the sensible future of space is European, why do we still need DARA? The most promising German initiative—Saenger—will certainly become an ESA project.

Rabenhorst: Today we are only at the beginning of the preliminary studies. It is a purely German project. If Saenger is really going to be built, ESA is certainly needed. But, on the way to that goal, under the conditions that prevail today in Europe, it is necessary to have an influential German voice—for example, that of DARA—in the ESA concert. Because, at the present time, we are not exactly represented there by the loudest instruments.

Italy: Selenia Spazio To Head SAT-2, DRS-1 Programs

MI890249 Rome AIR PRESS in Italian 4 Apr 89 p 631

[Text] The JCB (Joint Communication Board) of the ESA [European Space Agency] has chosen the Italian company Selenia Spazio to lead its SAT-2 and DRS-1 programs. The favorable opinion of the consulting board enables Selenia Spazio to present bids which will be examined by the IPC (Industrial Planning Committee) by 23 May. According to French sources, the choice of the Italian company was recommended by the organization that heads the European telecommunications program, also in consideration of the fact that Italy alone was ready to provide the necessary financing. Selenia Spazio will direct the final study (B2 stage) for the SAT-2. During the previous stage, Selenia Spazio was involved in this study together with Aerospatiale, MATRA, and Alcatel Espace. Selenia Spazio will also head the study on the adaptation of the payload to the existing platform chosen for the two DRS-1 satellites (the fourth element of the "Columbus" system). This platform will be the "Eurostar" 2000, developed by British Aerospace in conjunction with MATRA. This was preferred to two other proposals, the body of the Italsat satellite proposed by Selenia Spazio, and Spacebus 100B. On the other hand, the ESA did not ignore Italsat.

When the JCB opted for the SAT-2 and DRS-1, ESA assigned the study of a possible combination of the Italsat 2 and SAT-2 payloads on the same platform to Selenia Spazio in association with the Spanish firm CASA [Construcciones Aeronauticas S.A.], Austria's OeRS [Austrian Space Flight Enterprise], and the Swedish company Ericsson. This will promote preoperative telecommunications service with moving earth vehicles. SAT-2 (see drawing), may be the first European satellite with ionic propulsion. Its IPP [Ion Propulsion Package] system will be developed by an Italian-German group. Selenia Spazio has been assigned the general conception and integration of IPP, FIAR the high voltage electricity supply, and Proel the neutralizer. The exhaust will be developed by the German company MBB [Messerschmitt-Boelkow-Blohm] in association with the British company Marconi. The Belgian company ETCA [Technical Studies and Aerospace Manufacture] will supply earth support and testing equipment. Future French participation by SEP [European Propulsion Society] is not excluded.

BIOTECHNOLOGY

Belgian Firm Introduces Molecular Farming Method

AN890140 Zellik TECHNIVISIE in Dutch 22 Feb 89 p 19

[Article by Jan Van der Cruysse: "Genetic Engineering: From R&D to Production"]

[Excerpt] [passage omitted]

Plant Molecular Farming

Last week the biotechnology company Plant Genetic Systems (PGS) proudly announced that it had found a successful method for "plant molecular farming," a world first.

Plant molecular farming is a method that uses agricultural crops as the raw material for producing chemical substances such as peptides. Economically important peptides are produced by the plant and stored in a stable form in specific parts of the plant, such as the seeds.

Thus, high concentrations of the required substance can be extracted from the plant in a simple and economical manner.

Possible applications currently involve mainly medical and pharmaceutical products, such as blood factors and growth hormones.

The main prerequisite for molecular farming is the development of molecular transformation techniques to create a plant variety that spontaneously produces and stores the desired end product. The technology was developed in close cooperation with Dr J. Vandekerkhove at the State University of Ghent. So far,

greenhouse experiments have shown that valuable peptides can be extracted from the seeds of genetically engineered colza plants. Extraction and purification of the peptides seems simple and efficient.

Traditionally, the same result has been obtained through microbial fermentation. However, this method is fairly expensive. Another possibility is to use animals to produce peptides. In this case the required proteins are concentrated in the milk obtained through a simple though labor-intensive process.

Plant biological farming techniques, however, seem more interesting for a number of reasons. "First, they are more efficient and cost effective," says PGS Director Walter De Logi. "A plant can be grown with water, suitable light, and soil nutrients, whereas animals must be fed and nurtured. Furthermore, there is a considerable risk that the production of specific substances in the animal can cause side effects. Finally, animals are more prone to disease, infections, etc. If the same results can be obtained through plants, the choice is obvious."

To the Fields

PGS will use the new technology to produce products for the pharmaceutical industry. The company will thus become a "high-technology farmer." PGS itself is going to develop, grow, and harvest the transgenetic plants from which the product will be extracted and then purified for the first time. The pharmaceutical company that commissioned the process is responsible for the further purification and marketing of the product.

The implementation of the know-how acquired should enable PGS to gain a strong market position in the production of various specific pharmaceutical products. Contracts have already been signed with a leading pharmaceutical company.

It is obvious that PGS has started reaping the benefits of its high-technology R&D efforts. The proceeds from these initiatives (molecular farming and the cooperation with Clause) are sure to generate new R&D projects in the field of molecular improvement.

COMPUTERS

Construction of First Technological Park Begins

36980224b Barcelona REVISTA DE ROBOTICA in Spanish Mar 89 p 24

[Text] Telescincro, Inc., laid the cornerstone of its new factory and main office in the Valley Technological Park during a ceremony on 2 December which was presided over by the president of the Cataluna community, Jordi Pujol. Telesincro is the first business to set up shop in "Silicon Valley." As is well known, the initial phase of the Technological Park is almost finished: 15 businesses have acquired their spaces (Hispano Olivetti, Inc.; Telesincro, Inc.; Grupo Comelta; T&G Internacional, Inc.; Ready Systems, Inc.; Takio, Inc.; Lana Sarrate, Inc.; Centro Tecnologico Ascamm; Telefonico; Craftsman, Inc.; CTA, Inc.; Balzers-Elay, Inc.; McDonell-Douglas; Semiconductores, Inc.; and Protoc Robotica), but Telesincro was the first to begin construction. Total capacity of the initial phase of the Valley Technological Park is 65 businesses. The second phase, which will triple the present area, will soon begin construction site work.

Telesincro will invest 1.1 billion pesetas in its new plants in the Valley Technological Park. The total area of the land acquired is 17,400 square meters, of which 8,500 square meters will be taken up by a single plant. Of the total investment, 450 million pesetas will be earmarked for modernizing its equipment by incorporating surface mounting technology and automating some of its processes. Within the next two years Telesincro will earmark 580 million pesetas for research for the design, among other devices, of pay terminals with memory, portable pay terminals using microchip card or magnetic tape, videotex terminals, etc. Telesincro foresees winding up the current fiscal year with an outlay of 3.7 billion pesetas, which would represent an increase of 76% over last year. In 1988 its exports will reach a value equivalent to 73% of its overall sales, with the EEC and the United States its primary markets.

European Firms Strive To Increase Competitiveness

France's Bull

36980213 Rotterdam NRC HANDELSBLAD in Dutch 14 Apr 89 p 14

[Article by Hans Wammes: "Bull Wants To Become Largest Computer Firm in Europe—But Results Remain Disappointing"]

[Text] Bull purchased a majority in the computer division of the American Honeywell company and thus became less dependent on France. But the corporation has a long way to go in order to safeguard its place in the world market.

Paris, 14 April—Didier Ruffat was struggling with a small Japanese laquered box. A simple device, said the people of the NEC computer manufacturer whom he had just received in his Paris office. The small box can be opened by sliding a few parts. But Ruffat, international sales director for the French computer company Bull, could not figure it out.

Superior Japanese technology has proven rather vexatious for the Bull managers, just as much as the tough competition on the world market of American computer manufacturers.

And yet, the difficulties Bull ran into during the early eighties were primarily of its own making. In 1982, they suffered a 1.4 billion franc loss with 8.1 billion in revenues. The reasons for this were, among others, too

large an inventory, too diverse and poorly coordinated activities and investments, a newly developed computer which had defects, and negative assets.

In order to safeguard the purely French corporation from ruin, the French government (which owns 92 percent of the coporation) put Jacques Stern at the helm of Bull. With the slogan "if you can't beat them, join them," he developed closer relations with NEC and American Honeywell.

In late 1988, Honeywell sold its computer division (Information Systems) to Bull. The Americans are left with only about a 20 percent interest in what is now called Bull HN Information Systems. NEC's share is 15 percent.

Bull is the largest division of the Compagnie des Machines Bull holding company and is active in North America, Great Britain, Italy, Australia, Africa and Asia. Until the establishment of Bull HN, its sister division Bull SA—only active in France—was by far the largest entity, with two-thirds of the group's turnover.

"The Bull Group is the only European supplier which is not dependent exclusively on a single national market for the major part of its turnover," announced Francis Lorentz (shortly to become Stern's successor) triumphantly, shortly after having obtained a majority in Bull HN. And: "We are the leading supplier."

Poor Health

Thus at least one goal was met: Bull wants to become the largest in Europe. "Experts feel that within a couple years there will be place for only three American, three Japanese, and one European computer manufacturer on the world market," said Ruffat.

But the size of Bull (now 45,000 employees) cannot hide the fact that the corporation has remained in poor health. It was not without reason that Lorentz referred to the 1988 results as "disappointing." It is true that profits rose by 35 percent to 303 billion francs (101 billion guilders), but with a turnover of 31.5 billion francs this does not even represent a full percentage point.

It remains to be seen whether or not the acquisition of a majority in Honeywell Information Systems will have a favorable impact on the group's results. The results and market share for this Honeywell section have been on the decline in recent years.

However, Ruffat does feel that—unlike its European competitors ICL and Nixdorf—an increase in turnover must continue to be given the highest priority. "This industry is truly international. If you want to make research and development profitable, then you have to work on a large scale."

According to the sales director, Honeywell Information Systems produces more than only purchased turnover. He sees possibilities of improving both the American leg and the performance of the group as a whole. "Honeywell's computer activities have never been more than a part of that corporation. Because they placed the emphasis elsewhere, too little has been invested in recent years. Bull could invest more, make joint purchases, eliminate overlapping. Furthermore, together we are better able to serve clients who are active at the international level." Ruffat expects that a better mutual tuning between Bull SA, Bull International and Bull HN could also rationalize the production of computer equipment.

Moreover, there was already talk of a further developed task distribution between Bull, NEC, and Honeywell. For example, NEC provides chips, technological knowledge and the mechanism for the distribution of Bull products in Japan. The Americans also provide technology, manufacture some of the computers in the Bull spectrum, and sell Bull and NEC products on their home market.

Bull—which also carries out research in Europe in cooperation with, among others, ICL and Siemens—considers those technological connections with the United States and Japan to be very important. Ruffat: "We cover the whole market and not niches. You cannot carry out research and development on your own."

Through the development of Bull HN, Bull can truly point to a broader international range. Europe now takes care of 70 percent of the turnover, 25 percent comes from the United States, and 5 percent from elsewhere. France's share in the Bull turnover has declined to more than one-third. The fact that Bull is becoming less French is not a bad development in and of itself. Because the market share in France has dropped since the French authorities have been relieved of their obligation to purchase Bull products.

"We do not need to deny our French identity," said Ruffat. "But Bull will now be seen primarily as a European company." And that is important also, because "1992 will be the next challenge." "Government, retail trade, manufacturing companies, the financial world: afterwards all of them will change," said the sales director. "There will be numerous complicated mergers, which entail serious risks. If a large bank with a Bull computer joins with a smaller bank with an IBM, you can count on it that they will go on with Bull. But conversely...."

With regard to European competitors, "1992" is nevertheless "an opportunity." "I do not want to make a judgment on other companies," said Ruffat, "but for many of them it will be a problem to remain independent."

However, honesty compelled Ruffat to note that Bull's market share in the countries of Northern Europe is too small to survive a competitive campaign over the next few years. "After all, you have to have a minimum of 5 percent market share," he felt,. whether through takeovers or not." It is said that the corporation has another billion guilders on hand for that.

Bull's productivity also needs to be improved. "It is lower than for others," admitted Ruffat. But that should not be explained to the disadvantage of Bull. "Hence, it is clear that we will be able to take advantage of a large reserve," he stated without blushing.

Critics of the company point out that Bull has more personnel than needed, but as a state company it dares not tackle this drastically. During the last year, the company has however started reducing the number of jobs, without dismissals as a matter of fact. Jobs are also supposed to disappear in 1989. In addition, the corporation is implementing re-training programs in order to make it possible for production personnel to work in sales and support services.

Research and development are not suffering from poor results. More than 11 percent of the turnover is spent in this area. Could this not be reduced some, now that the group's turnover has increased so much with the addition of Bull HN? Ruffat made a face, stuck out his tongue and made a rude noise. "You could reduce everything, but then you automatically end up with problems. We must become more economical. But 1 percent in profits is still better than a loss."

UK's ICL

36980213 Rotterdam NRC HANDELSBLAD in Dutch 17 Apr 89 p 19

[Article by Hans Wammes: "Size Not Determinant for ICL Profits—Strong Austerity Measures Pulled British Computer Company Out of Losses"]

[Text] The wishes of leading European computer companies are very different. One primarily wants to become large; the British company ICL strives to become rich. A large takeover in the Federal Republic would fit this goal very well.

London, 17 April—International Computers Limited [ICL] used to be larger. Serious losses in 1981 forced the British company to eliminate 10,000 jobs. At the present time, ICL produces computers with a personnel figure of only 4,000. And the results have never been this good.

"It is not a question of size," noted Nigel Hartnell, who is in charge of marketing and strategy at ICL Europe. "It is a question of searching out the good markets and spending your money well."

The recent ICL figures—since 1984 a component of the STC computer and telecommunications corporation and in 1988 responsible for 58 percent of its turnover and 54 percent of its profits—confer dignity to his words. ICL recorded a turnover of 1.36 billion pounds (4.9 billion guilders) and achieved operating results of 129 million pounds (467 million guilders). This does not make ICL the largest computer company by far, but a very profitable one. And this is what it is about, said Jean-Claude Albrecht, the French "president" of ICL Europe.

In the early eighties, when computer gurus were thinking exclusively in terms of unbridled growth, this ability to think in relative terms had already been raised to the level of highest wisdom within ICL. By conducting a policy relatively free of risks, it was able to free itself from the then prevailing malaise.

Acquired markets were carefully maintained and only gradually broadened. The company entered into numerous realtionships with companies "which had something to offer." Computer research and development divisions and vital components were kept, and part of the production was contracted out. Within several organizations, the ICL also emerged as a strong supporter of technological standardization.

Geographically, ICL has not allowed itself to be tempted into adventures either. Expansion is always sought on known territory, which also includes former colonies. In terms of turnover the United States and Australia are important, but in terms of market share a large number of other Commonwealth countries also carry weight. Incidentally, ICL leads the market on the Fiji Islands. Of the five computers installed there, four are from ICL.

On the European continent ICL does not represent much. The STC management does have enough ambitions on the European continent, but recent acquisitions in the computer branch involved only companies in the United States. Last year the turnover in Great Britain—with 800 million pounds—remained three times higher than elsewhere in Europe, where 240 million pounds were earned.

And yet, asserted Hartnell and his boss Albrecht, continental Europe can expect things from ICL. "At the present time, 90 percent of our discussions about companies are taking place in Europe, outside the United Kingdom," said Albrecht. "Because we are too weak in Europe. We would like to purchase something big in 1989."

According to Albrecht, STC would be able to come up with £1 billion for acquisitions. "But money could be found for more if this should prove profitable." ICL believes it will be able to carry out profitable takeovers in the market segments of telecommunications and retail trade, and in the automation of production companies, banks and insurance companies, and in public services.

Currently, 55 percent of ICL's turnover comes from the supply of equipment, but Hartnell expects that the share of programming and computer services will grow. "When we propose a computer system to a client he does not necessarily have to purchase ICL products. A client should see us as a systems house. He should know that we will not talk him into buying computers in order to feed our own plants."

ICL does feel that it is necessary to keep abreast of technological developments, and keeps the necessary knowledge available. The manufacturing of vital chips for the large computers, mainframes, are contracted out with the Japanese Fujitsu company. And the microcomputers which ICL will be supplying shortly come from Taiwan. Hartnell: "The microcomputer has become a mass product. You can buy them everywhere. Why should we invest in them ourselves then? Our strength is to include that thing in a system."

The lion's share of the 20,000 ICL workers are working in sales and support services. What ICL itself still makes in terms of computers is large machines, made to the client's specifications. This is a way the company can distinguish itself, and the ICL strategist asserted that there is hardly any cost differential compared to manufacturers in low wage countries. "For this type of computer, labor costs amount to only 5 to 6 percent. Even though this turns out to be more expensive, our production control, supply and distribution are more important then."

The post-1992 open European market is a beckoning prospect for ICL. Hartnell thinks they will be able to benefit more from this than their European competitors. Meanwhile, unlike Bull or Siemens and Nixdorf, ICL has become used to a liberalized market. When the tied purchase system imposed by the authorities was canceled for ICL, the company had to learn to fight for its major contracts with, among others, British Telecom and British ministries.

Even though according to ICL this was a relative success, it did not provide it with a position on the continental European market. With 300 million guilders, ICL France is the largest European subsidiary, followed by the Netherlands and Denmark, each with a turnover of 150 million. Frantic efforts to set a foot on shore in Germany—one of Europe's largest markets—have not been very successful so far. In 1987, investments there led to about 35 million guilders in losses. And yet, the turnover for 1988 did not amount to much more than about 75 million.

But, expanding on his European aspirations, Hartnell did not want to hear any objections: "Does Siemens have such a strong international position in computer technology then? It does not represent anything in France or in our country. And is Philips international? Yes, it has 800 light bulb manufacturing plants. But when you see what they are doing in terms of computer systems, that is disappointing."

The ICL manager once again emphasized that the size of a company is arelative concept. "If you have a turnover of 1 billion pounds, then you are not a large automation company. But if in the mid-nineties we were to have a turnover of 1 billion pounds in the retail trade sector, then we would be a world market leader. And as a supplier of computer systems to the retail trade, production companies, financial institutions and public services we are in the top three in Europe and in the top five worldwide. That is where our strength lies."

According to Hartnell, ICL's strategy and the capital behind the STC group are enough of a guarantee for European expansion. Over the next 3 years ICL wants to multiply its turnover in the above mentioned markets by a factor of five or six. It goes without saying that this is possible only through a large number of takeovers.

Against this background, Hartnell and his boss, Jean-Claude Albrecht, noted that not all companies are for sale. Albrecht admitted that Nixdorf would be a beautiful target. "The company is on its knees. But it is surrounded by so many protective devices—which is also true forDutch companies—that I simply cannot buy such companies."

Nevertheless, Nixdorf's struggle is followed with great tension in the ICL buildings on the banks of the Thames. Hartnell: "In a single move, Nixdorf has changed its horizontal organization into a vertical one. You lose an enormous amount of control that way. When you have problems already, such a step represents a serious risk."

If Nixdorf does not succeed in getting back on the right track, then ICL will get a unique opportunity to acquire shares on the highly coveted West German market in market segments where it feels at home. Comments made by Albrecht point in this direction: "Our greatest weakness is West Germany, but I am hoping to remedy that within the next 12 months," he said.

Italy's Olivetti

36980213 Rotterdam NRC HANDELSBLAD in Dutch 18 Apr 89 p 14

[Article by Dick Wittenberg: "Olivetti Must First Prove Itself on European Market"]

[Text] Among the European computer manufacturers, the Italian Olivetti company is "the first to be ready for the nineties." Boast? The forward advance has been stagnating in recent years. But Olivetti has managed to climb out of a deep valley before.

Ivrea, 18 April—More than 10 years after Carlo de Benedetti took pity on Olivetti and thus started the metamorphosis from an insolvent typewriter manufacturer to a successful computer company, the firm once again finds itself in a transition phase. Diminishing results and encroaching market changes are forcing the corporation into reorientation and restructuring.

But apparently, E. Piol has no doubts about the outcome. The vice president of Olivetti, responsible for strategy and corporate development, drew on his large cigar like Groucho Marx, waved his arms full of bravado like Harpo Marx, and said in Chico Marx's Italian-American accent: "We are the first to be ready for the nineties."

This smells of boasting, but that is also what the sober skeptics thought 10 years ago when De Benedetti proclaimed the resurgence of Olivetti. Since then the company's turnover has quadrupled to 10.6 billion guilders in 1987, and the net profits have been multiplied by twelve to 594 million guilders. Seven years after the corporation made its entry onto the European personal computer (PC's) market, Olivetti is the largest manufacturer after IBM, with a 10 percent share.

What is less well known is that with a 5 percent market share, the corporation can also call itself one of the largest European suppliersof mini's, medium sized computers, said Dr. B. Lamborghini, vice president for Strategic Analysis and Planning. In addition, Olivetti still has a dominant position in the traditional area of office equipment, such as typewriters (mechanical and electric), adding machines, word processors, and copier systems. All of this resulted last year in a ninth position on the world list for suppliers of computers, communication and related material, immediately following the German Siemens corporation.

And yet, these glorious accomplishments cannot hide the fact that the forward advance of Olivetti is stagnating. Since 1984, the production results in percentage of turnover have consistently continued to fall. It is true that for a few years the corporation was able to compensate for this decline thanks to a financial reorganization carried out by De Benedetti, but in the meantime this source of income has virtually dried up. In 1987, for the first time since the seventies, Olivetti had to announce a drop in profits of more than a quarter.

At the headquarters in Lombardy's Ivrea, E. Piol carelessly wiped away that little speck. He noted that 1987 was a disappointing year for all computer companies. In addition, he said that last year Olivetti recovered effortlessly from that small relapse: the figures which will be available only next week, will prove that. And that is all the more remarkable, according to Piol, because 1988 was a "year of transition" for Olivetti. In 1988, the corporation completely renewed its assortment of PC's and mini's. In 1988 also, Vittorio Cassoni, De Benedetti's successor as daily manager, made Olivetti's new organizational structure known worldwide.

Since 1 January of this year, the company has been divided into three working companies to be managed as separate firms. Olivetti Office, with a turnover of 5.4 billion guilders, will concentrate on office equipment and wants to increase productivity through a cost decrease and rationalization; Olivetti Systems and Networks, with a turnover of 5 billion guilders, will supply computer systems and aims at an increase in added value via software and service. And then there is also the Olivetti Information Service, with a turnover of 800 million guilders, led by Franco De Benedetti, Carlo's brother, which is to develop into a European scale software house through, among other things, acquisitions.

"Olivetti has become too large to operate as a single company," said Piol. "The office sector has to compete with the Japanese, and the computer division has to measure itself against the Americans. And the software group in turn also has its own rivals. The various management sections need to provide their own manner of leadership."

That sounds very logical, but analysts and others who speak ill have said that so far the splitting up of Olivetti has led only to a great deal of anxiety and a mutual power struggle. Piol did not want to conceal the fact that opinions about the reorganization are divided within the company also. He is even willing to admit that the reorganization harmed Olivetti's growth last year. "But in 1989 the advantages will become apparent," said Piol optimistically. "The improvements will be visible also in the results."

Piol can become particularly angry about colleague companies, such as Siemens and Bull, which claim that the production of mainframes, large central computers, is an absolute condition to ultimately be of any account within this branch of industry. "Nonsense," exclaimed Piol vehemently. "The opposite is true." He compared mainframes with luxury apartments in a villa district which is gradually deteriorating into a poor neighborhood. "Then you can still give the outside a coat of paint or put flowers in the yards, but you cannot prevent the decline. I am glad that we do not depend on mainframes."

Dr Lamborghini meaningfully recited the growth prognoses: 20 percent for PC's, 10 percent for mini's, 5 percent for mainframes. He said that last year, for the first time in history, the market share for mainframes was smaller than that of the mini's and the PC's: 12 billion dollars as against respectively 13 and 16 billion. "We do not believe in the centralization of computer processing," said Lamborghini decisively. "We think that soon the mainframes will no longer be the heart, but only a part of the computer system."

Olivetti is also going against the grain in its geographic approach. While Siemens, Bull and Philips are droolingly leering at the American market, for now Olivetti is

very consciously limiting itself to Europe. The Italians did try to get a foot on land in the United States before, but that was a "mistake," said Piol. "Our product offer was not good enough. And at the time we did not have enough resources at our disposal to build up a position in the long term either."

The relationship with the American telecommunications company AT&T, which according to the 1983 announcement should have grown into a worldwide association, also dates from that period. It never got that far, among other reasons because the merger of computers and telecommunications took place much less quickly than either of the partners had expected. AT&T still has a 22 percent interest in Olivetti, about as much as De Benedetti. Last year, AT&T also took away more than one-fifth of Olivetti's PC production.

But aside from that, in the United States Olivetti concentrates primarily on the small markets on which it has a strong position, such as banking systems. "Our priority lies in Europe," stated Piol. "We first have to make sure that we will benefit from the elimination of the borders; that is vital. It is only after we have proven to be able to handle American competition on our own market that we may have a chance of success in the United States."

FRG's Nixdorf

36980213 Rotterdam NRC HANDELSBLAD in Dutch 19 Apr 89 p 15

[Article by Hans Wammes: "Nixdorf Believes that After Drop in Profits It Will Emerge Independent from Pit—Seriousness of Situation Underestimated"]

[Text] Nixdorf is having a hard time. But the management feels that this is temporary. This is a portrait of a computer manufacturer who wants to remain among the top six in Europe.

Frankfurt, 19 April—Do not mention takeovers or mergers to Klaus Luft. In the meantime, the president of Nixdorf Computer is working on a thorough restructuring, which is supposed to lead to profit recovery in the nineties. As an independent company.

Luft: "Perhaps we should have reacted more quickly to market signals. We saw other large computer companies, such as IBM, record lower profits and reduce their personnel. But things were going well for us. And then it is hard to determine when you will take measures."

That moment came during the last 3 months of last year. From his headquarters in Paderborn, Luft shocked the outside world and his more than 30,000 co-workers with the announcement that the results had been so disappointing that before the end of those same 3 months 1600 jobs would be eliminated, and the same would happen again this year. This came as a hard blow within the company, which had known uninterrupted profits and turnover increases since 1976.

In 1988 there was still a 5 percent increase in the turnover, up to DM5.34 billion. But profits—DM264 million in 1987—shrunk to DM26.4 million. As a matter of fact, if it had not been for one time profits from the sale of immovable assets there would even have been a loss of nearly DM16 million. Nixdorf felt that this drop in profits was serious enough not to pay any dividends to the large shareholders in 1988 (the Nixdorf family and two foundations connected to the company), who hold half the shares and have the right to vote. Small shareholders received 40 percent of the dividends they received in 1987.

Golden Balance Sheet

Luft knew that the plans to reduce the number of personnel and dividends would be a hard blow. Internally they were not aware enough of the seriousness of the situation. "I told the works council that our company's productivity was too low. They said: 'But Mr Luft, the newspapers say that we have a golden balance sheet.' Even there they did not understand that we would have to cut."

In order to give a clear "signal," the Nixdorf management decided to propose a dividend reduction. But they also had another reason. "Nixdorf needs the money badly in order to guarantee its continuity."

Nixdorf's difficulties are recent. In 1987, the corporation was still able to show a 13 percent growth in turnover and a 19 percent growth in profits. The prospects were rosy. It was only around the middle of last year that the first reports of moderate results appeared and that prognoses had to be amended.

However sudden this may have been, the causes of the drop in profits were not solely incidental. "Structurally our costs are too high," said Luft. "Furthermore, our margins were also narrowed by the high prices of chips and stronger competition in computer equipment."

Those high chip prices will blow over. But the toughened competition will not. Luft feels that the market threshold has become too low for that. "Because of standardization it is easy to manufacture computers. These days, everyone can purchase chips at Intel and operating programsat Microsoft."

In order to keep its market share, Nixdorf also threw itself in the price battle. This is apparent from the 1988 sale prices: even though the margins shrunk by 20 to 30 percent, the figure still represents a 9 percent higher turnover in hardware. Hence they are selling, but the profits have dropped considerably.

Partly for this reason Nixdorf is increasingly concentrating on providing computer programming and services. "That is the key to stable development," said Luft. "Even though equipment is constantly becoming more standardized, buyers continue to request unique solutions."

At the present time, the West German computer manufacturer is making roughly 40 percent of its turnover from "software and services" and the remainder from hardware. The turnover share of software and services is expected to continue to grow. But research, development and sales in this area require a great deal of money and manpower. These are important causes of the corporation's problems. One-third of the personnel have been working for Nixdorf less then 2 years. You cannot expect too great a productivity from them yet, said Luft. But his personnel costs last year did increase by 16 percent. In addition, the costs for research and development amounted to 10 percent of the turnover, and that is higher than is the case for many competitors.

Goods Made To Order

Nixdorf's emphasis on strengthening its software and services sections would seem to indicate that the corporation is less interested in hardware. Luft disagrees with that. He swears by the production of their own equipment, because then clients can be supplied with complete Nixdorf systems. But it is true that Nixdorf's equipment, based on their own technological standards, has passed its prime. Although Luft feels that his own systems are the best, he complained that their development is too expensive. This is why Nixdorf is increasingly making a choice for hardware and software standards which are also fashionable elsewhere. "You can very well use standard products from third parties to supply your clients with made to order equipment," he said.

"Look, within the European computer industry we are among the five largest," he said. "But if you also count the American companies, then we end up in 16th place. Given the rapid changes in technology it is better for us not to strike new paths on our own but to adjust to the standards which are used all over the world."

According to Nixdorf, stubborn initiatives which do not conform to a "world standard" do not agree with the European expansion they seekeither. The company holds a dominant and relatively protected position on the West German market, which allowed it for a long time to play a pioneer role. But growth within the Federal Republic is stagnating. Last year, Nixdorf's national sales amounted to DM2.8 billion, only 2 percent more than the previous year. Abroad (read: in Europe) the corporation sold 9 percent more than in the previous year.

Could merging with another European computer manufacturer give Nixdorf the scale needed to be at the forefront instead of remaining dependent on competitors? Luft rejected that suggestion out of hand: "Mergers provide big headlines in the newspapers," he said. "But most of the time they fail. In our branch this is not a serious subject of conversation."

Nor does he see any parallels with the telecommunications industry, where even very large companies are joining together in order to be able to come up with the hundreds of millions of guilders in development costs for new telephone exchanges. Nixdorf's president said: "Size in our branch is only important for mass products, such as microcomputers. The computer market is much more diversified. And it is precisely for that reason that cooperation—unlike merger—is so popular these days. You simply can no longer handle everything by yourself."

However, in the short term Nixdorf's improvement of profits will have to come from internal changes: cost control, especially through personnel reduction, and a new corporate structure. The latter includes a shift from one organization per "Land" to one organization per group of buyers. In this respect, Nixdorf started with markets in which it now holds a good position. Thus divisions have been set up for banking, medium and small size businesses, retail trade, telecommunications, government and major clients. These divisions are expected to be able to detect the client's needs earlier and be able to more quickly hook into them.

Substantial sums have been set aside for the necessary adjustments within Nixdorf itself. Immovable assets have also been sold in order to free money because, as Luft noted, "we have a great deal of work left to do this year."

Cooperation Revives Industry

36980213 Rotterdam NRC HANDELSBLAD in Dutch 20 Apr 89 Supplement p 6

[Article by Hans Wammes and Dick Wittenberg: "Revival of a Sluggish Branch of Industry—Developments in Computer Branch Work to the Advantage of European Industry"]

[Text] The Americans and Japanese dominate the world computer market. Even in Europe they are leading. But new developments in that branch of industry are playing into the hands of European manufacturers who are used to a fragmented market. The shift to software and service—the major growth market in which big money can still be earned—is also to Europe's advantage. Cooperation is the word, but a number of computer manufacturers will not survive the turmoil of battle.

"What do you mean, weak?" Dr. G. Lorenz, the only foreigner on the board of the Philips group, reacted with genuine surprise. "What do you mean that the starting position of the European computer industry is weak? After all, we have a very decent position in Europe, don't we?"

That may be true, but on a world scale the European computer industry is nothing more than a collection of neighborhood stores which are having a hard time holding their own against the supermarket chains and are dreaming that one day they themselves may turn out to be someone like Albert Heijn.

Europe still purchases more computers than it sells. Of all the computers being made, European companies manufactured only 18.9 percent in 1988. But of all the computers being bought on the world market—a 340 billion guilder volume—Europe purchased 29 percent. On their own European home market, only 46 percent of the sales were in the hands of European firms. While they had barely got a foot on the ground outside Europe. Among the top 20 listed in the American journal DATAMATION, the first European representative, Siemens, was only in 7th place: behind the broad backs of 3 American and 3 Japanese companies.

According to G. Sorg, director of Siemens, there are a few very banal explanations for the fact that the European information technology [IT] industry is lagging behind. First of all, the computer industry got off the ground much earlier and much more rapidly in the United States than in Europe. During the Second World War already, and certainly immediately afterwards, the Defense Department and companies in the United States were working closely together in the development of ever larger, ever more powerful computers. Until 1957 there was absolutely no question of a computer industry in Europe. Sorg: "The dominant position of the Americans is not due to their competitive power but to their early entry onto the market."

In addition, said N. Hartnell of the British ICL company, the fragmentation of the market has made European firms slow and sluggish. "National administrations took all kinds of measures to support their own industry; the markets were very highly regulated," said Hartnell. The result was that the European computer companies barricaded themselves like gorged cats in their own home markets where they could thrive without too much effort. Consequently, they were inadequately equiped for the tough competition on the world market.

E. Piol, a member of Olivetti's Board of Directors, said that the European computer industry also made a number of "historic mistakes." Europe has always been tearing along blindly behind the United States, instead of reacting to market changes itself and having confidence in its own strength, said Piol. "When the European companies began their catching up operation in large computers, they completely missed the boat on minicomputers. When next they paid full attention to the mini's, they were late again with the PC's."

In a report on the world IT industry, the American Arthur D. Little agency mentioned another reason why European companies were pushed onto the defensive even on their own European home markets: "Lack of cooperation." Mutual distrust was so great that any attempt at cooperation proved to be doomed. The low point in this cold war among companies was the 1975 breaking up of Unidata, the large computer cooperation between Bull, Siemens and Philips.

Metamorphosis

But since then, the composition of European computer companies has drastically changed. The whole industry has experienced a metamorphosis. Thus the mainframes, the large computers, are no longer the driving power in this branch of industry. Through the application of ever quicker, ever more powerful chips the minicomputers (with sale prices ranging between 50,000 and 500,000 guilders) have in many instances superseded the mainframes. At the same time, the capacity of personal computers has continued to grow and they in turn have taken over all kinds of tasks from the minicomputers.

Consequently, the growth of the mainframe market is lagging more and more behind. It is true that the markets for mini's and PC's are still increasing in absolute figures, but those segments in turn have to do battle with murderous competition and strong price pressure. As a result there is also pressure on the turnover growth in these sectors. This means that the computer industry, which for 20 years has been used to growth percentages of more than 15 percent, now suddenly has to adapt itself to the market stagnation. Which in this branch still comes down to an average increase of between 5 and 10 percent.

Parallel with the leveling out of growth, the influence of clients isincreasing. For decades the manufacturers terrorized their clients by each one of them coming up with their own computer operating system.

The result was that the computer equipment from the various trademarks was not compatible and all of them needed different software. Hence, a company which had purchased a certain trademark was automatically stuck with that trademark. Or else the company owned several computer systems but an exchange of information was impossible. "The consumers were dumb enough to conform themselves to the producers," said Siemens Director G. Sorg.

But that era of computer slavery is coming to an end. The buyers are demanding the freedom to purchase their new computer equipment wherever they want to, independently from what they purchased earlier. They finally also want to draw the maximum benefits from all those information systems by integrating them in a company-wide network.

Hence, "standardization" and "open systems" are currently the magic words in the IT industry. Personal computers already have a de facto worldwide operating system, specifically MS-Dos. Partly due to strong pressure from the European companies such a standard also

seems to have been developed now for minicomputers, although a great deal of scuffling is stil going on about this. At least equally important is the fact that this so-called Unix standard makes compatibility between various computer systems possible.

Standardization and open systems lead to the steadily decreasing importance of hardware, of equipment. "These days, everyone can purchase chips from Intel and operating programs from Microsoft," said K. Luft, president of Nixdorf Computers. Thus computers are increasingly becoming commodities, bulk products with large margins. The added value is to be found increasingly in software, in applications, in services. That is the area in which manufacturers can distinguish themselves. That is the major growth market in which big money can still be made.

Whether their name is Siemens or Olivetti, Bull or Nixdorf, Philips or ICL, all European companies agree that the metamorphosis of the market works in favor of the European computer industry. Although it is true that standardization and open systems, combined with "Europe 1992", means that European firms can no longer bask in the protection of their own home market. But, on the other hand, they themselves can now penetrate other markets much more easily.

Sorg feels that the market shift in favor of software, of applications also works in the hands of the European industry. "The Americans have always thought that they would be able to serve the whole world with a single solution. While, because of the fragmentation of our market, we have always been forced to adapt to individual needs. That historical disadvantage is now turning into an advantage."

Olivetti's E. Piol stated categorically: "I am convinced that in the new computer world, which is no longer determined by manufacturers but by clients, the European industry will be playing a much larger, much more important role. I believe that Europe has learned from its historic mistakes." He pointed, among other things, to the greatly increased wilingness of European companies to cooperate: in standardization, in product exchanges, in basic research. He also said that the 12 largest European IT companies have joined together in a "Round Table," which is striving for more far-reaching forms of combining strength. The first thing to think about in this respect is the joint development of products, said E. Piol, but he also feels that the formation of joint ventures and common production are not impossible. "Everyone is bursting with goodwill."

Hence a revival of the European computer industry? D. Ruffat, director of the French Bull company, was also very willing to bet on that. He did, however, want that not all European computer firms would share in this revival. Ultimately the market will become more international, competition tougher, and the hardware margins narrower. The European companies which survive this slaughter will be stronger coming out of the battle. Others will fall in the tumult of the battle.

The main question is how well the various European companies are equiped for this inevitable cutback in the IT industry. The Arthur D. Little agency has drawn up a short list with requirements which a computer company will have to meet in order to be among the victors in the nineties. Such a firm must be able to serve its international clients anywhere in the world. The company must have a network of strategic alliances at its disposal as well as good relations with ancillary suppliers and clients. In addition, the company must be able to provide solutions to measure and to integrate systems. And the company must be able to react rapidly to new technology and be good at product development.

Moreover, the European firms will have to handle their own "survivor profile" themselves. "Companies which want to remain on their feet during this new phase of the computer industry," said Siemens' Sorg, "will have to be active in a broad area both geographically and in terms of applications. In addition, they will have to have a great deal of money at their disposal." His colleague at Philips, Lorenz, referred to the following as key factors: "an adequate distribution organization, a strong client base, and significant market shares in specific areas." And Olivetti's Piol feels that "good financial performance" is the most important next to "capacity to adjust to market changes."

Weak Spots

Not one of the European corporations is able as yet to meet all those criteria. They all have their own weak spots. Five out of the 6 companies are dependent on Europe for 70 percent or more of their turnover. Siemens, ICL, and Nixdorf even rely on their own home market for the lion's share. Only Bull managed to conquer a substantial position in the United States last year through the acquisition of the Honeywell computer division. But how that adventure will turn out is still a question, because that computer division has been struggling for years with decreasing market shares and results. In addition, there is the fact that the profitability of the French state run company is already low. Olivetti's Piol said compassionately: "I wish Bull much luck with that acquisition. I think that it is courageous but very risky."

The balance of strengths and weaknesses can be easily expanded: Nixdorf has always been good with applications and software, but was too late in adjusting to market developments and is fighting with far too high costs. ICL is making fat profits, but is technologically a follower. Siemens is financially super strong but is having a hard time adjusting to the advent of the PC's and mini's. Olivetti wants to profile itself as a fullfledged

system supplier but is still known as a "PC farmer." And what about Philips? "Philips," said Olivetti's Piol, "I don't understand what that company is working on."

It is true for all European computer companies that with the current volume, the current strength, and the current markets, they cannot survive independently. That is why all European firms are very busy compensating for their respective handicaps. Philips and Siemens are lying in wait for a major purchase or important cooperation in the United States, ICL is striving for a takeover on the European mainland, preferably in Germany, Olivetti has just gotten through a reorganization and is investing heavily into software, Bull is making serious efforts to integrate its American activities, and Nixdorf is restructuring and lowering costs.

The strategy followed by the companies in this respect is closely related to the products they sell. Siemens, Bull and ICL are all three mainframe producers. Thus they are putting a great deal of emphasis on scale enlargement. "To increase our turnover is our greatest priority," said Bull's Ruffat. His Siemens colleague, Sorg, also predicts that "a minimum share of the world market, let us say 5 percent, will soon be necessary in order to be able to finance a new generation of mainframes."

According to Philips' Lorenz this need to enlarge the scale, with market concentration as logical consequence, applies only to mainframes and definitely not to the rest of this branch of industry. Nixdorf's Luft added: "The clients increasingly need made-to-measure work and unique solutions. In this respect, scale size is of no importance at all."

But companies such as Olivetti, Philips and Nixdorf, which do not manufacture mainframes, cannot escape further internationalization either, even if only to be able to serve their clients in as broad an area as possible, both geographically and in terms of applications.

Only, this does not have to occur through a costly takeover or a sensational merger, said Nixdorf's Luft. "It is precisely for this reason that cooperation is so popular these days."

The European computer industry is still nothing more than a collection of neighborhood stores which have difficulty keeping a foothold against the supermarket chains and are dreaming one day to become someone like Albert Heijn themselves. But at a time when clients are crying for personal attention and care, supermarkets may well be at a disadvantage as against cooperation among neighborhood stores.

Darmstadt Called FRG's Software Development Center

36980230b Munich INDUSTRIEMAGAZIN in German May 89 pp 143-146

[Article: "Software's Comfortable Residence"; first paragraph is INDUSTRIEMAGAZIN introduction]

[Text] Darmstadt—The small city between the Rhine and the Odenwald does not have to fear comparison with its large neighbor Frankfurt in high-tech matters. In software it even sets the tone.

Guenther Metzger, Darmstadt's mayor, has every reason to be grateful to his father. He set the course correctly more than 40 years ago as the first postwar mayor: In the 80-percent destroyed town, Ludwig Metzger directed economic reconstruction with the motto "noiseless, odorless, and smokeless".

The city is now reaping the benefits of this idea which would be called "green" by today's standards. The former Hessian capital—free of belching smokestacks and bothersome skyscrapers—is a picturesque gem with lively cultural activities.

This ambiance has recently been attracting a remarkable number of software firms. Here in the midst of the economically flourishing Rhine-Main conurbation, the guild of information scientists is finding fulfillment of the high demands for quality of life typical of that group.

But it has more than just charm. It also has very substantial local advantages such as proximity to the Frankfurt airport and to large EDP users in the financial and chemical metropolis on the Main, a well-developed infrastructure, and the renowned Technical University, in addition to professional schools and a respectable number of technically attractive institutes and organizations.

With purposeful promotion of trade and industry, Mayor Guenther Metzger today sees to it "that even in the future ecologically responsible, future-oriented high-tech firms will locate and feel at home in Darmstadt."

The most recent example of the successful acquisitions policy is the sale of a parcel of city land to CA Computer Associates GmbH. This German branch of the largest independent software supplier with worldwide annual sales of more than $700 million will build its new administration center on a 20,000-square-meter piece of land in the Eberstadt quarter.

The five-story building complex should be ready for occupancy in fall 1990 and offer some 350 employees room to work in 7,000 square meters of office space. "But that will not be enough," admits CA CEO Mario Pelleschi. Therefore, the management of the software firm is already planning a second, long, seven-story structure with a parking deck which will be able to accommodate an additional 400 computer specialists.

For now, the top administration of the dynamic growth firm is located approximately 6 kilometers away from Darmstadt in Weiterstadt. Naturally, this community is less than happy to lose its powerful tenants. After all, in fiscal 1987-88 the German GmbH managed to more than double its annual sales compared to the preceding year; since 1982, the number of employees has risen

from 60 to 370. "We are bursting at all our seams," explains CA CEO Mario Pelleschi, "and in the search for land for a new building we finally ran out of time."

Darmstadt got the message first. Real estate department head Dr Lutz Wessely offered the revenue-rich software customizer an acceptable building site under clearly attractive terms. And thanks to Darmstadt's committed consultant for promotion of business and industry, Werner Vauth, as CA management also acknowledges, all the competent agencies reviewed the application for construction permits swiftly without red tape and approved them quickly.

Mayor Metzger, who only created the position of full-time promoter of business and industry about a year ago, considers his action validated, "Industry needs a contact person who is familiar with its needs and understands it problems. That makes it easy for the firms here to resist relocation offers from other communities."

Because the structural characteristics of the city are easy to see:

- Approximately 37 percent of workers are employed in the processing industries and more than 60 percent are in the area of trade and services. The so-called "sectorial structure" is thus balanced and resilient.
- In Darmstadt's mix of sectors, growth sectors such as electronics technology, mechanical engineering, chemical firms and printing companies dominate, while declining industrial sectors such as steel and textiles play no role or are completely absent [as published]. "Our economy is hardly susceptible to structural and economic crises," stresses the mayor, "because the businesses have hardly any mass production, with small series production and custom orders dominating."
- The service area is dominated by public and private research facilities and institutions as well as technology-oriented service companies.

In the relatively small city of 120,000, where the landgraves and then the grand dukes of Hesse-Darmstadt used to reside, it is primarily the guild of programmers that has built its nest in recent years. Approximately 50 software companies employ well over 1000 information scientists here.

The oldest company in town, the AIV GmbH, has only a modest 15 employees, but is the cradle of numerous spin-offs. Thus, for example, Peter Schnell, chairman of the board of Software AG, comes from here. In the past few years, the company founded in 1969 has blossomed into the largest German supplier and sparkles with its double-digit growth rate; and, in the company headquarters in Darmstadt alone, there are about 600 employees. In 1988, they brought in sales of more than DM170 million.

The actual strength of this group managed from Darmstadt is much greater: Worldwide, more than 2,000 employees brought approximately DM450 million into the coffers and made the programming company one of the 100 largest information technology firms in the world.

Another offspring of AIV, albeit not quite so successful, is Darmstadt's second largest software company, Software Partner GmbH (SP), founded in 1972. With barely 100 employees, the EDP firm is among the most experienced here in the FRG in the difficult information and communications business. Along with four subsidiaries, all headquartered in Darmstadt, in 1987, SP's people achieved sales of approximately DM13 million.

With the relocation of Computer Associates, the Darmstadt software community can really make itself seen. At the same time, the substructure of the sector, i.e., small but innovative newcomers and young entrepreneurs in and around the former royal capital—right up to the gates of Frankfurt—is becoming increasingly stable.

The Nation's Graphics Software Gurus

They all enjoy a crucial locational bonus: There is a wealth of young new specialists and expertise in the area because cooperation with the Technical University (TH) and the professional schools is extremely good. "The firms offer our students ample trainee positions and are always suggesting thesis topics," Prof Wolfgang Henhapl of the Informatics Department expresses his satisfaction with the local industry.

Not by chance does the Technical University (TH) of Darmstadt enjoy the reputation beyond the borders of the republic as one of the bastions of German information science. Of the approximately 7,000 students enrolled at the TH during the 87-88 winter semester, about 1,800 were working on software topics. Everything that Darmstadt offers in graphic data processing is on the cutting edge worldwide.

Already in the mid-1970's, Prof Jose Encarnacao was building the area of interactive graphics systems (THD-GRID) in the Institute for Information Processing and Interactive Systems at the Darmstadt TH. Since that time, Darmstadt has provided general training in graphic data processing (GDP) to more than 2,000 students and has produced approximately 600 majors. Wherever this field is taught in any FRG university, the chances are good that the instructor is a product of Encarnacao's GDP program.

Experts predict a boom during the 1990's for this technology with which graphics and monochromatic and color images are captured or generated, managed, represented, manipulated, and processed with computer assistance.

"Right now," warns the dynamic Portuguese Encarnacao, "virtually all systems for graphic data processing are still imported from the United States and Japan." To create an adequate domestic market for German manufacturers, the number of firms and subsidiaries capable of integrating this technology into their products must be increased. "And, along with the technological development," acknowledges the professor, "above all, we must train the necessary engineering and management personnel."

This and much more is taking place in Darmstadt in the so-called "House of Graphic Data Processing," which includes three independent institutes with distinct emphases under one roof:

- Under the University Chair for Interactive Graphics Systems (GRIS), technology transfer such as training and continuing education are taking place along with market-independent pure research.
- The Fraunhofer Work Group for Graphic Data Processing (FhG-AGD) founded in 1987 is dedicated to applied research. The employees develop appropriate products for industry, construct prototypes, and implement pilot system installations.
- And finally, the Center for Data Processing e.V. (ZGDV) is the third developer of technical expertise in the group. This non-profit organization's objective is to promote the use of graphic data processing for educational and research purposes in accordance with the wishes of its founding partners—seven industrial firms in addition to the Darmstadt TH. Today, virtually every firm with a place and name in data processing is on the ZGDV membership roster.

The future-oriented Institute for Integrated Publication and Information Systems (IPSI) founded in 1986—an offshoot of the large research institute GMD (Society for Mathematics and Data Processing) is working with yet another software concern. At IPSI Prof Erich J. Neuhold and his approximately 70 employees are testing and developing user-friendly models for computer aided publishing. Here again proximity to actual practice is cultivated. The group insists on close cooperation with authors, graphic artists, typesetters, layout people, and editors. Professor Neuhold stresses: "Perhaps then we could actually get started in a few years on the desktop publishing systems which are so prematurely touted today."

Experts Have a Firm Grip on the Satellites

The scientists of another Darmstadt facility are already concerned with the issues of the next century: Since 1968, the European Space Operations Center ESOC here has been monitoring and controlling ESA satellites in space day and night by computer.

Thanks to expensive software and attentive ground controllers, for example, ship-to-ship telephone communication is possible, television weather forecasting is illustrated with images, and television images find their way around the globe. In Darmstadt, scientists from all over Europe make sure that none of the satellites leaves its prescribed orbit. The space inspectors suddenly found themselves in the unfamiliar public spotlight in 1986 when the European space probe Giotto monitored by them passed Halley's Comet and researchers from all over the world followed this event "live" from the ground station.

They had to put up with long commutes from their lodging because hotel beds are chronically scarce in Darmstadt, and 98-percent occupancy is not rare.

Probably that is the price which must be paid for the fact that a 1987 EC study found that the Darmstadt administrative district is the most lively economic region with the best local conditions in all of Europe.

This judgment admittedly had a slight flaw in the opinion of the city: "The EC analysts divided the 12 member countries into 160 districts, and the entire Frankfurt metropolitan area is included in the South Hesse administrative district of Darmstadt," Mayor Metzger smilingly explains the impressive assessment. However, if things go his way, this rating should someday apply to Darmstadt alone.

Innovation Resources Near Darmstadt: Types of Expertise Offered to Companies by the Research Region

Institution: Darmstadt Technical University [TH] Key areas of emphasis: Mechanical engineering, electrical energy technology, electronic communications technology, control and data technology, information science Address/Contact: Karolinenplatz 5, 6100 Darmstadt; Consultant for Research Affairs Dipl.-Eng. Heiner Stoecker; Phone: (0 61 51) 1 61

Institution: Center for Graphic Data Processing (ZGDV) Key areas of emphasis: R&D, continuing education and user seminars in data processing Address/Contact: Bleichstrasse 10-12, 6100 Darmstadt; Chairman of the Board Prof Jose Encarnacao; Phone: (0 61 51) 1 00 00

Institution: Research Institute of the German Federal Postal Service at the Long-Distance Technology Central Office Key areas of emphasis: Information processing, exchange and transmission processes, long-distance networks, solid-state electronics, optoelectronics Address/Contact: Am Kavalleriesand 3, 6100 Darmstadt; CEO Ronald Dingeldey; Phone: (0 61 51) 6 31

Institution: Fraunhofer Institute for Serviceability (LBF) Key areas of emphasis: Development and improvement of computerized and experimental measurement processes, optimization of components and design, determination of component-related behavior of advanced materials Address/Contact: Bartningstrasse 47, 6100 Darmstadt; Institute Director Prof Otto Buxbaum; Phone: (0 61 51) 70 51

Institution: Society for Heavy Ion Research m.b.H. (GSI) Key areas of emphasis: Pure research with accelerated heavy ions, especially in the areas of nuclear physics, nuclear chemistry, atomic physics, and biology Address/Contact: Max-Planck-Strasse 1, 6100 Darmstadt; CEO Prof Paul Kleinle; Phone: (0 61 51) 35 91

Institution: Battelle Institute e.V. Key areas of emphasis: Contract R&D in the areas of biotechnology, production technology, materials, electronics, information technology Address/Contact: Am Roemerhof 35, 6000 Frankfurt 90; CEO Dr Helmut Rabenhorst; Phone: (0 69) 7 90 80

Institution: DECHEMA—German Society for Chemical Instrumentation, Chemical Techniques, and Biotechnology e.V Key areas of emphasis: Promotion of joint research between chemists and engineers in the areas of mechanical, instrument, and systems engineering; materials technology; labor and operations technology; measurement and control technology Address/Contact: Theodor-Heuss-Allee 25, 6000 Frankfurt 97; CEO Prof Dieter Behrens; Phone: (0 69) 7 56 40

Institution: Institute for Biophysical Radiation Research Key areas of emphasis: Pure research on the effect of ionizing radiation, aerosol biophysics Address/Contact: Paul-Ehrlich-Strasse 20, 6000 Frankfurt 70; Director Prof Wolfgang Pohlit; Phone: (0 69) 63 63 85

Institution: Max-Planck Institute for Biophysics Key areas of emphasis: All departments are working with membranes and the transport processes taking place in them Address/Contact: Kennedy-Allee 70, 6000 Frankfurt; Prof Reinhard Schloegl; Phone: (0 69) 6 30 31

Netherlands Involved in Four ESPRIT II Projects

AN890164 Amsterdam COMPUTABLE in Dutch 7 Apr 89 p 2

[Article by Maud De Sitter: "Four ESPRIT Projects From Eindhoven University Receive Grant—Two Million Guilders for Basic Research"]

[Text] Eindhoven—In the appropriations round for the "ESPRIT II Basic Research Action," the European Commission accepted four project proposals from the Technical University of Eindhoven (TUE). For these projects, the TUE will receive more than 2 million guilders in subsidies spread over 2 and ½ years. In addition, the university is going to participate in two other approved research projects.

The "Basic Research Action" differs from other ESPRIT (European Strategic Program for Research and Development in Information Technology) projects in that virtually no companies are involved in it. Most of the 283 proposals for basic research projects within the scope of ESPRIT II were submitted by scientific institutes. The Commission has approved 62 projects, 18 of which involve Dutch universities.

The management information systems and automation group of the TUE's Industrial Engineering Department is responsible for the "Factory of the Future" project, which is studying definition methodologies for CIM (computer-integrated manufacturing) systems. In this project, TUE is cooperating with the Institute for Information Technology and Product Automation (ITP, Eindhoven), which is the project manager; BIBA (University of Bremen); CIMRU (University College, Galway, Ireland); GRAI (University of Bordeaux); SINTEF (University of Trondheim, Norway); the Technical University (TU) of Denmark; and the Helsinki University of Technology. The total budget amounts to 1.8 million guilders, of which 350,000 guilders will go to the TUE.

The TUE's electrotechnical materials science group is participating in a project called "Electrical Fluctuation and Noise in Advanced Microelectronics: Submicronic Two-Dimensional Gas and Low-Temperature Devices." This project focuses on research into the electrical behavior and noise levels of semiconductor components in very thin structures. The project is coordinated by the National Polytechnic Institute of Grenoble (INPG), which is associated with the University of Grenoble and which has a cooperation agreement with the TUE. Other participants are: the Universities of Lille and Montpellier (France), Modena (Italy), and Utrecht (Netherlands); the French National Center for Telecommunications Studies (CNET); the Leuven-based Interuniversity Microelectronics Center (IMEC, Belgium); and Plessey (UK). The TUE has been granted 250,000 guilders out of the overall 2-million-guilder budget.

The project "Behavioral Synthesis, Partitioning, and Architectural Optimization for Complex Systems" aims at automatically converting formal job or problem descriptions into chip designs. The TUE's automatic systems design group will primarily concentrate on the development of such descriptions, for which it has received 700,000 guilders. The remaining participants are IMEC, the prime contractor; the INPG; the Technical University of Darmstadt (FRG); the Technical University of Denmark (Lyngby); and the University of Patras (Greece).

The project "Formal Methods and Tools for the Development of Distributed Real-Time Systems" is led by the TUE's information science group, which has been allocated a subsidy of 600,000 guilders out of the overall 2.5 million budget. The other project participants are: the Universities of Grenoble (INPG), Liege, Manchester, Nijmegen, and Oxford; the Imperial College (London); the Institute of Computer Science (Crete); the Swedish Institute of Computer Science; and the Weizmann Science Institute (Israel).

Through ITP, the TUE's systems and control engineering group is involved in the project "Early Process Design Integrated with Control" (EPIC), which seeks to develop a system prototype enabling process developers to speed up installation procedures. In addition to

project leader Intrasoft (Greece), the participants are: the Greek companies Planet, Metek, and Motor Oil Texas; the British SAST; the Dutch Baan Info Systems (Barneveld); and the City University of London.

Finally, it is expected that the TUE will be involved in Polyglot, which was submitted by the Philips section of the Perception Research Institute (IPO). [IPO is the joint responsibility of Philips Research Laboratories and the TUE.] This project focuses on the development of a system for automatic speech recognition and synthesis in all (seven) languages of the EC. The remaining participants are: project leader Olivetti; Triumph Adler; Philips Forschungslaboratorium Hamburg; the French Computer Laboratory for Mechanical Engineering Sciences (LIMSI); the Universities of Bochum, Edinburgh, Nijmegen, and Patras; and the Polytechnic University of Madrid.

[Box]

Technical University Delft Also Involved in ESPRIT II

Delft—The Department of Mathematics and Computer Science of the TU in Delft is involved in an ESPRIT II research project on CIM systems, called "Distributed Manufacturing, Planning, and Control." In this project, the TU of Delft is cooperating with the London Imperial College, the British company Research & Development Projects, and the West German Krupp Atlas Dataensysteme. The TU is participating through the knowledge-controlled systems group led by Prof Dr H. Koppelaar. The project will require a total of 27 man-years over a period of 3 years. Its goal is to increase productivity by expanding decisionmaking authority to lower levels. This is likely to require the use of expert systems.

Madrid University, Siemens Cooperation on AI Project Reported

36980224a Barcelona REVISTA DE ROBOTICA in Spanish Mar 89 p 24

[Excerpts] The Polytechnic University of Madrid and the Siemens Company, Inc., recently signed an accord on cooperation and aid in a ceremony at the university. The accord includes a project on artificial intelligence, specifically intelligence in cognition, expert systems and office automation, as a result of which Siemens will accept degree and scholarship holders from the school of data processing in the firm. [passage omitted] Siemens, relying on its softwear development center in Cornella, is working on various projects in the field of artificial intelligence such as automatic translation of natural languages and expert systems, and now has agreements with other universities including: Polytechnic University of Barcelona, a collaboration with the school of data processing on integration of Spanish language elements into the "Metal" translation system; University of Barcelona schools of philosophy and psychology for formulating rules for the Castillian language for "Metal;" the Autonomous University of Barcelona school for translators and interpreters for determining rules of transference from the "Metal" system; and the School of Advanced Studies in Blanes on a project for objective representation in hybrid systems.

ENERGY

FRG's Kohl Outlines Environmental Plan

36980222a Paris AFP SCIENCES inFrench 3 May 89

[Text] Chancellor Helmut Kohl on 27 April affirmed to the *Bundestag* his government's commitment on behalf of environmental protection by stressing that his country was ready, if necessary, to go it alone within the European Economic Community. Mr Kohl pointed out his wish to bring about in Europe a significant reduction in pollution generated by exhaust gas from automobiles by requiring installation of three-way catalytic converters to satisfy U.S. standards. He stated that such equipment will be required in the FRG effective 1 October 1991 regardless of the outcome of negotiations entered into on this subject within the EC. In the future, automobile tax will be computed based on automobile pollution and not on engine cubic capacity. Before the end of the legislative term (December 1990), buyers of cars with engine cubic capacity below 2,300 cubic meters will receive the same tax breaks as buyers of large engine cubic capacity if their vehicles are equipped with a three-way catalytic converter. Mr Kohl reaffirmed his government's intention to link payments by Third World countries to measures in support of the environment. The Chancellor felt that environmental protection should be included in basic West German law.

Sweden-USSR: Cooperation Agreement on Environment

36980222b Paris AFP SCIENCES in French 3 May 89 p 39

[Text] The Swedish Minister of the Environment, Mrs Birgitta Dahl, and her Soviet counterpart, Mr Fedor Morgun, on 28 February in Stockholm signed a cooperation agreement on environmental matters. The agreement provides for setting up a Russo-Swedish standing committee responsible for putting together a bilateral operational program. The document, the first at this level signed by the new Soviet minister, provides primarily for the exchange of information on atmospheric, surface and maritime pollution in the Baltic, originating from Lake Ladoga and around the Kola peninsula. Mr Morgun stressed that the USSR, after long neglect of environmental problems, was now devoting much greater attention to them. This new policy, he said, is exemplified by the construction of a network of waste treatment factories which will be completed in 1992-93. "We hope in this way to reduce pollution by 30 to 50 % and even, in some cases, by 80 %," the Soviet minister stated, emphasizing that "some of the funds previously earmarked for defense were now going to be shifted to the fight against pollution."

LASERS, SENSORS, OPTICS

Italy: Research Center for Sensors Established

MI890252 Milan ITALIA OGGI in Italian
18 Apr 89 p 10

[Text] The Milano Ricerche consortium, whose task is essentially to promote and coordinate the activities carried out by universities and private enterprises in high-technology projects, has opened a sensor research center in Milan. Sensors which detect and measure chemical and physical quantities are widely used in a large number of industries.

The new sensor laboratory was inaugurated last Thursday by Giampiero Cantoni, president of Milano Ricerca, and by Giovanni Nassi, managing director of the Bicocca Project. The laboratory is located in the Polo Technological Center developed by the Pirelli Group in the former industrial area known as Bicocca. CEFRIEL, the Center for Research and Training in Computer Science Engineering, was also opened there last January. The laboratory was developed with the cooperation of academics from the Departments of Chemistry, Physics, and Electrochemistry of Milan University. Its objective is to stimulate and encourage the development of gas sensors by making its know-how available to large and small business enterprises. According to promotors, the new facilities should provide operational support to all companies requiring an objective assessment of the quality and reliability of the sensors they manufacture.

Why sensors? The project by Milano Ricerche is part of the significant attention that is being paid to sensors by world industry today. Indications are that worldwide production of sensors will increase considerably over the next decade, with a jump in total sales from 17,500 billion lire in 1988 to 5 trillion lire in the year 2000. According to estimates (the most recent are by Prognos of Basel and the Teknibank-Bias 89 study for the Italian market), high-tech, innovative sensors will register the highest growth rate.

The laboratory established by Milano Ricerche aims to bridge the gap between domestic production which, with few exceptions, covers only the least innovative sectors of the sensor industry, and that of leading countries in the field such as the United States and the FRG.

The gas sensor decision was not made by chance. These sensors have better prospects: between 1988 and 1995, their growth rate in the world market is estimated to be 250 percent, or in monetary terms, from $500 million to $1.75 billion.

MICROELECTRONICS

Goals of JESSI Program Discussed

AN890133 Paris ELECTRONIQUE HEBDO in French
30 Mar 89 pp 12-13

[Article by Elisabeth Feder: "The Only Thing JESSI Is Waiting For Now Is Funding"]

[Text] The definition phase of JESSI, the European microelectronics project, has come to a close with the publication of a "Green Paper." Although some details remain to be finalized, work can begin. The only thing still pending is the release of funds.

The Joint European Submicron Silicon Initiative (JESSI) project is nearly ready, now that the definition phase has ended. Plans for the development of integrated-circuit technologies over the next 8 years are, for the most part, complete. Decisions are now pending from the member-states and from the EC Commission regarding program subsidies. How they will be divided among the various subprojects will be decided as concrete work plans emerge in the form of "Blue Papers."

For the moment, a management committee composed of a maximum of eight members needs to be set up as quickly as possible. Its first task will be to act as liaison between the governments and the EC. In addition, an equivalent committee should be created on the industrial level; it could begin its activities before the end of the "acceptance phase." However, the Green Paper does not discuss certain practical aspects, such as an industrial strategy (in particular, cooperation among the various manufacturers according to their interests) or program organization and management, which remain to be clarified. Likewise, the EC Commission should decide soon whether or not it wants to contribute to the program's funding. JESSI would then conclusively become part of the EUREKA program, with which, incidentally, the project is already registered, under reference number EU 127. Other points that need to be clarified are how companies that might join the program at a later date would participate in it, or how companies that do not want to, or cannot, take an active part in the project in the strict sense could have access to its results. The extreme variety of the activities of the participating companies sets JESSI apart from other similar initiatives, such as Sematech.

Whether Europe needs a project like JESSI is no longer being questioned. In the opinion of project officials, the important thing is to reach a technological level that will ensure Europe's relative independence. Microelectronics has taken over almost all industrial products; this, in turn, has allowed them to remain competitive. Everything depends on the local availability of strategic integrated circuits and the resources necessary to manufacture them, from the design phase to production. "We must not depend on American or Japanese goodwill." Europe's consumption of integrated circuits is currently double its production of them. In 1987, the EC countries had a turnover of about $600 billion in the computing, communications, electrical engineering, precision optics and mechanics, robotics, and machine construction fields. Staffing amounted to about 8 million employees. The goal is to safeguard the competitiveness of European industry in all these sectors, with the long-term aim of maintaining our standard of living.

The strength of European industry lies today in its "systems" expertise. According to estimates, by the year 2000 half the integrated-circuit market will consist of

custom-made circuits (the much-vaunted ASICs [application-specific integrated circuits]), which will contain an entire system on one chip. This is where JESSI, with its four subprograms, comes in. Initially, the development of sophisticated technologies will take place alongside and in close connection with the development of the materials and equipment needed for mass production. This phase will be followed by the development of design tools and of prototype systems intended for key applications sectors within European projects ("Europrojects").

JESSI's first subprogram, its "technologies" component, is also the most worthwhile. It will lead to complementary metal oxide silicon (CMOS) technology in 1996, with 0.3 >mm for future generations of dynamic random access memory/ video random access memory (DRAM/VRAM), static random access memory (SRAM) and erasable programmable read-only memory (EPROM). Two intermediary stages will involve the successive development of 0.7 >mm and 0.5 >mm technologies. However, JESSI's central goal goes much further than just designing memory components. Its aim is to make it possible to develop, on the basis of current 1 >mm technology, technologies for digital circuits, either for designing microprocessors or gate-array networks (relatively easy to derive from memory circuits) or for designing more sophisticated BiCMOS or electrically erasable programmable read-only memory (EEPROM) circuits. The same goal was pursued by Siemens as part of its Mega project; here the intention is also to move toward complex circuitry beyond memory components.

Currently, the three main manufacturers of semiconductors—Siemens, Philips, and SGS-Thomson—have begun work in 0.5 >mm. Because of this and the choices made in the past—for example, in the context of dielectrics, which are different for an SRAM, a DRAM, or an EPROM—it will not be possible to standardize future technologies completely. Cooperation among the three firms on 0.5 >mm technology, and also in part on 0.3 >mm technology, will be devoted to developing process modules, component and process modeling, reliability problems, and various aspects of production techniques.

As far as 0.3 >mm technology is concerned, new developments will be necessary with respect to materials and processes. The ideal situation would be to arrive at a basic CMOS process that would meet the particular requirements of each firm's applications. From there, each firm could develop its range of products; its competitive position on the market would thus be guaranteed. In exploiting the research results, each firm will subsequently have to improve the process in terms of cost in its own manufacturing unit.

To complement this production aspect, the second JESSI subprogram has a dual task. On the one hand, the problem for manufacturers of semiconductor equipment is to design systems suited to the production of 16- and 64-Mbit memories, in cooperation with the manufacturers of integrated circuits. On the other hand, there is the different and more difficult task of creating a solid customer base for these manufacturers into the next century. During the definition phase of JESSI, certain choices had to be made regarding equipment that would make the best use of the particular skills existing in Europe at the time.

These choices concern: the automation of clean rooms using, for example, equipment for wafer manipulation, storage, and quality control; equipment directly linked to the technology (diffusion furnaces, ion implantation, etching, etc.); lithographic equipment to support developing technologies (optical lithography, for example); alternative technologies researched under the basic research subprogram (X-ray or electron beam lithography); assembly and testing equipment for short-term use that is reliable and easily adapted to future technologies; and materials, including the development of high-quality silicon as well as of the materials used in the production process (photosensitive resins, gas, chemical products) and casings.

Initially, interested companies will have to submit proposals for the development of equipment; some of these proposals will be followed by the development of prototypes for use in a pilot production unit. Right from the start the equipment will be designed to deal with 200-mm-thick wafers. During a subsequent selection stage, the most suitable prototype will be fine-tuned with a view to producing manufacturing equipment. The aim of the "applications" subprogram is to develop computer-aided design (CAD) tools for the development of complex integrated circuits and their integration in systems, as well as the design of microelectronic systems prototypes for strategic applications sectors of the Europrojects. The three main features of the subprogram have been defined as follows: The CAD tools and development environments must be both competitive and sufficiently flexible to enable each firm, particularly small and medium-sized companies and industries, to fulfill its requirements; the prototype systems created as part of the Europrojects must serve as a test vehicle for the CAD tools; and, lastly, training programs at universities and technical schools should yield a certain number of specialists in the job market. Two projects, JESSInet and the European CAD Initiative, should, respectively, ensure communication among partners through a network and enforce standardization and coordinate activities among participants.

The fourth JESSI subprogram is devoted to basic research. Its aims are threefold: in the short term, support for the technologies developed so as to permit the rapid creation of prototypes; in the medium term, the development of alternative solutions to ensure technological continuity; in the long term, to guarantee technological continuity once again, through research into new methods and technologies for the post-JESSI era.

It is no longer possible to conceive of components containing up to 10 million transistors in terms of reliability or the time needed to design them with current

methodologies. The same applies to physical design, where it will be necessary to take new problems into account, such as the effect of parasites. A certain number of projects have already been defined and grouped into four categories: design methodology (design methods and tools for ultra large-scale integration (ULSI) circuits, and design of circuits at the systems and technological level); modeling and simulation (of the process, basic components, or complete circuits); research into the various stages of the process (submicronic lithography, etching, ion implantation, thermal treatment); and process integration (new components and structures, bonding techniques, assembly and encapsulation techniques, analysis, testing and measurement).

Basic research, carried out as much by working groups in industry as in laboratories and universities, is closely linked to all the JESSI subprojects. In the first two phases, research will have to be carried out by industry. In the third phase, the initiatives will come from the laboratories.

Reference

"Results of the Planning Phase in "JESSI Green Paper"—Itzehoe, February 1989

Technological Data

	1990	1993	1996
Technology (structures)	0.7 >mm	0.5 >mm	0.35 >mm
"Vehicle" circuits (in million):			
DRAM	4	16	64
SRAM	1	4	16
EPROM	4	16	64
Number of transistors per circuit (in million):			
Memory	60	300	1,000
Logic	6	30	100
Maximum surface area of circuit	100 mm^2	200 mm^2	500 mm^2

Main features of 0.7 >mm, 0.5 >mm, and 0.3 >mm technologies

[Box, p 12]

Cost of JESSI

Spread out over the next 8 years, the overall cost of the JESSI program should total about Fr 27 billion—in other words, 2.3 billion in 1989, 3.26 billion in 1990, 3.8 billion in 1991, 3.9 billion in 1992, 3.88 billion in 1993, 3.66 billion in 1994, 3.4 billion in 1995, and 2.78 billion in 1996. The four subprograms, "technologies," "equipment and materials," "applications," and "basic research," represent 41 percent, 13 percent, 32 percent and 14 percent of the program, respectively.

The evaluation of these costs is based on staff requirements totaling 21,4OO man-years: 1,685 man-years in 1989, 2,615 man-years in 1990, 3,090 man-years in 1991, 3,145 man-years in 1992, 3,120 man-years in 1993, 2,940 man-years in 1994, 2,615 man-years in 1995, and 2,190 man-years in 1996. Here the breakdown among the four subprograms is more equitable, with, in the same order as above, 29 percent, 15 percent, 34 percent, and 22 percent, respectively.

[Box, p 13]

FRG Ready To Go

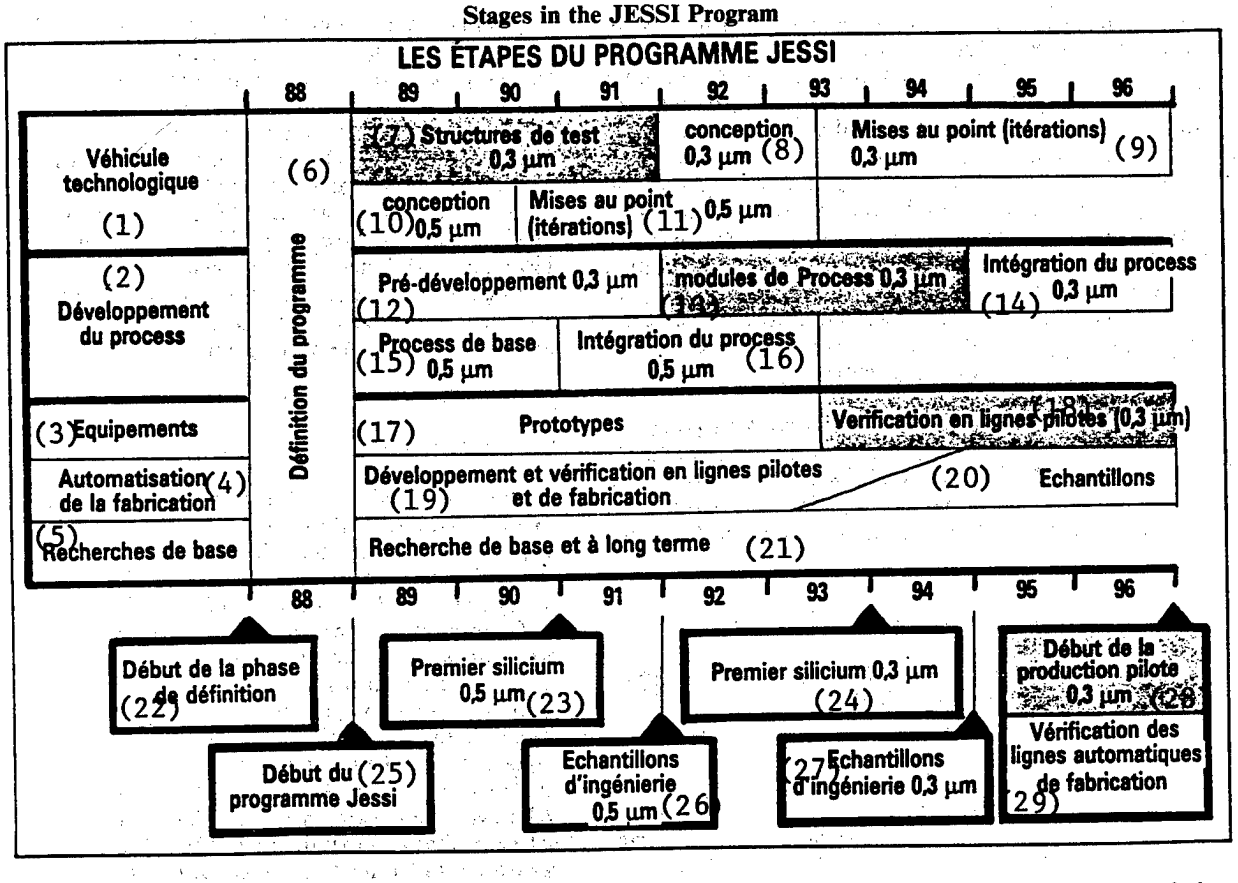
At the FRG Ministry for Research and Technology (BMFT), DM 45 million, or more than Fr 150 million, is already available to fund the project's definition phase (which has been extended to about mid-1989), its preparatory work, and the start of JESSI itself. A total of Fr 3,400 million has been allocated up to 1996. The government has indicated its willingness negotiate in each case, but it has also said that funding decisions will be made in close cooperation with the governments of the other partner countries. Is this because the FRG is supposed to make the greatest contribution to the funding, possibly up to 35 percent of the total subsidies? Whatever the reason, critics of JESSI seem to be more active in that country than elsewhere. This is even true regarding the ministry, which also seems to favor a request from IBM (which is firmly established in the FRG with research and memory production units) to take part in the project. Would this be a good thing? The possibility of European access to Sematech via IBM is (still) illusory; the Philips subsidiary in the United States has been refused access to the American microelectronics research project on the grounds that it is part of a European group!

[Box, p 13]

Companies Involved

AEG Aktiengesellschaft (FRG); Alcatel NV (France); ASM International NV (Netherlands); BMW AG (FRG); BOC Limited (UK); Robert Bosch GmbH (FRG); Bull (France); CNR-Progetto Finalizzato (Austria); Convac GmbH (FRG); DSM (Netherlands); Fraunhofer-Gesellschaft e.V. (FRG); Gesellschaft fuer Mathematik und Datenverarbeitung mbH [Mathematics and Data Processing Company] (FRG); Hoechst Aktiengesellschaft (FRG); IMEC [Interuniversity Microelectronics Center] (Belgium); Krupp Atlas Elektronik GmbH (FRG); L'Air Liquide (France); LETI [Laboratory for Electronics and Computer Technology] (France); Leybold AG (FRG); MHS Matra-Harris Semiconducteurs (France); Nixdorf Computer AG (FRG); Philips (Netherlands); Philips-Volvo (FRG); The Plessey Company PLC (UK); SGS-Thomson (France, Italy); Siemens AG (FRG); Karl Suess

Stages in the JESSI Program



The partial aim of JESSI is, on the one hand, to ensure to the best possible degree the transition between existing and new technologies and, on the other hand, to organize offensives in submicron technologies with 0.3 mm and 0.5 mm stages. These offensives concern basic research, process development, and equipment.

Key:
1. Technological vehicle
2. Process development
3. Equipment
4. Production automation
5. Basic research
6. Program definition
7. 0.3 >mm test structures
8. 0.3 >mm design
9. 0.3 >mm development (iterations)
10. 0.5 >mm design
11. 0.5 >mm development (iterations)
12. 0.3 >mm predevelopment
13. 0.3 >mm process modules
14. 0.3 >mm process integration
15. 0.5 >mm basic process
16. 0.5 >mm process integration
17. Prototypes
18. Verification on pilot production lines (0.3 >mm)
19. Development and verification on pilot and full productionlines
20. Samples
21. Basic and long-term research
22. Start of definition phase
23. First 0.5 >mm silicon
24. First 0.3 >mm silicon
25. Start of JESSI program
26. 0.5 >mm processing samples
27. 0.3 >mm processing samples
28. Start of 0.3 >mm pilot production
29. Verification of automated production lines

Microelectronics Applications Projects of the JESSI Program
LES PROJETS APPLICATIONS EN MICROELECTRONIQUE DU PROGRAMME JESSI

	(1) Television haute définition	(2) Contrôle numerique pour ecrans haute resolution	(3) Radio-cellulaire	(4) Composants pour le RNIS	(5) Electronique automobile	(6) Traitement/reconnaissance voix/image	(7) Microprocesseurs Micro-ordinateurs	(8) Circuits (Risc) monolithiques pour stations de travail	(9) Famille de blocs de base Asic	(10) Processeurs de signaux	(11) Electronique industrielle	(12) Asservissement numerique	(13) Nouvelles architectures de processeurs	(14) Télécopie grand public	(15) Contrôleurs Risc embarqués	(16) Commutateurs téléphoniques	(17) Systèmes graphiques	(18) Videophones video/audio 64 kbits/s
FhG		■	●			●		●	●	●	●							
SEL/ Alcatel	●		●	●		●			■	●								■
LoeweOpta	●	●		●	●	●												
ABB			●						●	●	●	●						
BMW					●													
Bosch			●	●	●	●			●									
Bull								●	●									
AEG/ Daimler			●	●	■	●			●	●	●							
KruppAtlas		■				■	●	●	■	■			■					
Nokia	●		●	●					●									
Philips	■		■	●	●	●		●	■	■	●	■	●	■	●	●	●	
Plessey				●					●									
Siemens	●		■	■	■	●	●	●	■	●	●			●	●	●		
Thomson	●	●	●	●					●	●								
ES 2								●	●									
GMD							●		●	●			■					
SGS-Thomson	●		●	●	●		●		●	●	●							
Alcatel (NL)																■		
PTT-Onl									●	●								
IOP-IC									●									
TPD-TNO									●	●								
TU-D						●												
DutchCTI	●					●				●			●				●	
OCE									●								●	
Sierra	●								●									
TU-Eindoven				●					●				●					
UniTwente									●									

Prototype microelectronic systems will be designed as part of the "applications" subprogram. Various proposals have already been made by a large number of companies. In this table, the names that are not linked to companies correspond to either universities or research laboratories.

SQUARE: Project initiator; BULLET: Project participant
Key:
1. High-definition television
2. Digital control for high-resolution screens
3. Mobile radio
4. Components for ISDN
5. Automobile electronics
6. Speech/image processing/recognition
7. Microprocessors/microcomputers
8. Monolith RISC [Reduced Instruction Set Computer] circuits for workstations
9. Family of basic ASIC units
10. Signal processors
11. Industrial electronics
12. Digital control system
13. New processor architectures
14. Mass telefax
15. On-board RISC controllers
16. Telephone switching systems
17. Graphic systems
18. Video/audio videophones (64 kbits/s)

KG (FRG); Stichting [as published] (Netherlands); Telefunken Electronic GmbH (FRG); University of Hannover (FRG); Wacker-Chemitronic (FRG).

Thomson's 1988 Results, 1989 Prospects Overviewed

AN890130 Paris ELECTRONIQUE HEBDO in French 30 Mar 89 p 3

[Article by Michel Heurteaux: "Thomson CSF: Net Results Up 14 Percent in 1988"]

[Text] The efforts undertaken by the world's number two defense electronics manufacturer have certainly yielded results. Its net consolidated profits last year were Fr 2.965 billion, an increase of 14 percent over the preceding fiscal year. Real profitability improved further with a net margin of 8.9 percent of turnover, as compared to 7.3 percent in 1987 and less than 1 percent in 1984. On the other hand, consolidated turnover showed some stagnation at Fr 33.514 billion versus Fr 35.877 billion during the preceding year. Nevertheless, the group enters 1989 with solid assets: Its net debt from industrial activities continues to decrease and was only Fr 1 billion in 1988; furthermore, its orders, totaling about Fr 63 billion, represent 2 years' worth of contracts. Thomson CSF directors believe that, barring some unforeseen event or

a noticeable deterioration in the economy, 1989 results should follow the current trend. With contracts up, loss centers declining, indisputable success, particularly regarding SGS-Thomson—Fr 1.084 billion net profit versus Fr 416 million in 1987—Alain Gomez, the group chairman whose term expires next June, can congratulate himself on a very solid balance sheet.

This balance sheet is undoubtedly the result of the industrial restructuring that has been conducted at breakneck speed for 3 years. These results are due to the elimination and direction of activities—along with the loss of 9,000 jobs—and redeployment toward new markets, in particular, the United States.

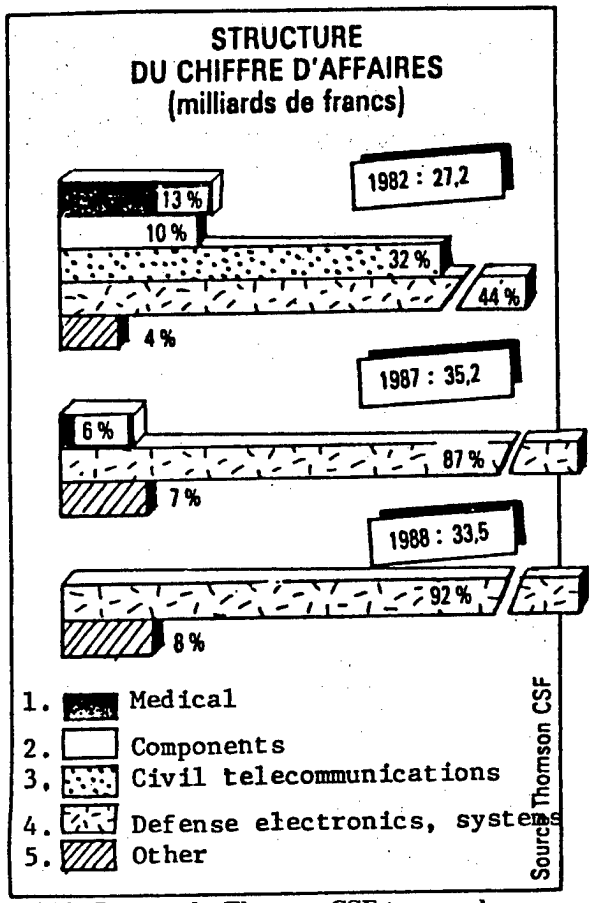
Inevitable Race Toward Mergers The course must be maintained in an environment that has become extremely competitive, even as the restructuring movement in the European defense electronics industry accelerates. Refocusing on basic industries has become more and more pronounced. For instance, the share of the "electronics and defense systems" sector, which previously amounted to only 44 percent of Thomson CSF's turnover, now represents 92 percent. Although the world market in defense electronics still amounts to almost Fr 530 billion, including Fr 100 billion for Europe, is it not about to experience some leveling off? This situation calls for some inevitable mergers. The race toward mergers has been going on at full speed for some months: GEC and Siemens joined in a public bid to buy Britain's Plessey, Daimler-Benz and its German partner MBB merged, and, more recently, Matra and Daimler announced an association.

What will Thomson's strategy be? Rather than acquiring share capital in other group members—a road chosen by the Matra group, for example—Alain Gomez prefers to create industrial units according to subsectors of activity, either through agreements among mutually owned companies or outright purchases. However, in this respect, the nationalized group has little room to maneuver. It does not have the financial resources to make "major acquisitions." There is thus no question for the future of the type of acquisition battle that was fought over Plessey.

Subcontracting Agreements

Thomson CSF, which represents a wide range of skills in the military field, could gain some excellent cards through subcontracting agreements. Alain Gomez believes that such agreements could provide an answer to the critically small size of some of these sectors in Europe. The French group has thus plunged into the merger game. Agreements between French companies cannot be ruled out and should theoretically encourage agreements among European companies. At a time when everyone is negotiating with everyone else, Thomson, which is well on the way toward financial stability, must succeed in the essential part of its new strategy, i.e., finding the right partner(s).

Structure of Sales (in Billion Francs)



Within 7 years, the Thomson CSF turnover has seen a complete restructuring. Defense electronics and systems activity now represents 92 percent of total sales, versus 44 percent in 1982. This reflects the decision to "go military," a decision that proved to be profitable, even though it was criticized by some experts.-

Orders for Defense Electronics and Systems (in Million Francs)

	1987	1988
Aviation equipment	7,500	8,200
Systems and weapons	7,800	7,100
Detection, control, communications	10,600	9,900
Special and passive components, various	3,000	3,400
Consolidated total	28,900	28,600
Book-to-bill	0.92	0.93

Source: Thomson CSF

Megaproject Develops 1-Megabit SRAM

36980236b Duesseldorf VDI NACHRICHTEN inGerman5 May 89 p 28

[Article by Jens D. Billerbeck: "SRAM's Achieve Megabit Dimensions: Access Times As Low As 20 ns Will Be Achieved"; first paragraph is VDI NACHRICHTEN introduction]

[Text] The great development efforts primarily in the field of dynamic memory components (DRAMs) are commonly referred to under the catchword "mega". However, static memory chips (SRAMs) also have similar technological and economic significance. The first operational 1-mbit SRAMs produced in Europe are now a reality. In terms of structural complexity they are quite comparable to the 4-mbit DRAMs.

With the DRAM, the cell required for storage of one bit consists of only a transistor and a capacitor. This simple structure results in the fact that for a 4-mbit DRAM with minimal structures of 0.8 microns approximately 91 square millimeters of chip surface are needed, and research is being performed worldwide on achieving even finer structures for 64-mbit DRAMs.

Within the framework of the Megaproject, the joint research project of the European semiconductor manufacturers Valvo and Siemens, Valvo has established itself for the first time in the memory component sector with the development of the 1-mbit SRAM. Later this year, series production of fast 64-kbit SRAMs is to begin, with the 256-kbit SRAMs scheduled for next year. According to information from Valvo, access times in these components are a minimum of 45 ns for the first type and as low as 20 ns with the second.

The SRAMs storage capacity, which is smaller by one-fourth with roughly the same area on the surface of the chip, is explained by the complex circuit structure of a memory cell: Here six transistors in a flip-flop circuit contrast with the DRAMs two components. However, this also constitutes a fundamental advantage of the SRAM, which retains its contents as long as power is present and does so with the usual small power requirement characteristic of CMOS technology. In contrast, the DRAM constantly requires refreshing of the memory contents, since the capacitor as an actual memory element does not retain its charge for an unlimited time. A pulse driven logic circuit, which naturally requires additional power, performs this refreshing. As a result, SRAMs have conquered the lightweight portable computer market, where every milliwatt of power consumption is hoarded in the interest of longer running time.

Compared to DRAMs, SRAMs have the advantages of quicker access times, lower power consumption, wider ranges of operating temperatures, and less sensitivity to interference.

Walter Conrads, the member of Valvo management responsible for microelectronics, sees the great demand for SRAMs in Europe itself as the reason for his company's success in the memory market. Valvo is the first European manufacturer to offer SRAMs with this level of performance. It is also assumed that, in contrast to the Japanese competition, the chances are good that a significant share of potential users is in medium-sized industries. According to Valvo estimates, the SRAM market in the FRG in 1990 will amount to approximately DM300 million and thus match that of the DRAM in terms of sales. The estimates are based on a 36-percent share for data systems engineering and a 38-percent share for industrial applications.

Philips Dedicates Megabit-Chip Plant in Hamburg

36980236a DuesseldorfHANDELSBLATTinGerman5 Jun 89 p 15

[Article: "Hamburg Megabit-Plant Operation Not Likely Before 1995"; first paragraph is HANDELSBLATT introduction]

[Text] The chip technologies of the next two generations of chips will be produced in the new Hamburg-Hausbruch plant. This was declared by the CEO of the Allgemeine Deutsche Philips Industrie GmbH (Alldephi), Cornelis Bossers, on the occasion of the dedication of the DM28-million development center for microelectronics in Hamburg. Just over 200 Philips employees from the previous development center in Hamburg-Lokstedt will work there.

However, construction on the megabit-chip plant, originally planned to begin operation in 1990, was obviously delayed. Because last year Bossers was still counting on completion in 1992, it is possible that the plant will not begin operation until 1995.

Bossers bases his decision for a delayed beginning of construction on worldwide fluctuations in production and demand for microelectronics components. Based on these movements, characterized by exaggerated optimism and hectic counterreactions on the demand side, as well as fluctuations in investments which could not be fully utilized at first on the supply side, the prognoses for worldwide demand have reportedly changed significantly.

Whereas in the 1985 planning phase, Philips assumed annual growth rates of 30 percent, the more recent forecasts mention only 10 to 15 percent growth in the chip market. According to Bossers, "It is understandable that such dramatic halving and thirding of predicted growth would affect the pace of investment in the chip industry." Consequently, the Philips plant in Hamburg will begin operation a few years later than originally assumed.

Bossers insisted emphatically that there is no technology gap separating Europe from Japan and the United States in integrated circuits in submicron technology. He claims that the Europeans can produce these circuits competitively.

Commenting on the continuing lack of customer acceptance, Bossers stated that it will be crucial to the future of European microelectronics that European user industries be as receptive and willing to use new components as the competition in the United States and Japan. He feels that mass production in Japan and the United States has its economic basis in the willingness of the user to accept new technology. Therefore, the DM8-billion European JESSI project should be a program with heavy user involvement from the beginning in preparation for use of the new generation of chips. Bossers is counting on the fact that the super-clean-room research for JESSI will be located in northern Germany. Investment costs for the super-clean-room research are estimated at almost DM500 million.

SCIENCE & TECHNOLOGY POLICY

EC Considers Revision of Framework Programs

36980233a Duesseldorf VDINAC HRICHTEN in German 5 May 89 p 19

[Article by Rolf Spitzhuettl: "The South Presents Its Case, New Conflicts on EC Research Funding Goals: Will EUREKA Programs Become Stronger Under EC Control?"; first paragraph is VDI NACHRICHTEN introduction]

[Text] The European research and technology policy which left the starting block 2 years ago with great difficulty is again the topic of conversation in the middle of the race. As in the past, conflicts about goals are dominating the new discussions of the Twelve—thirteen, counting the EC Commission.

The reason for this is a half-time assessment of the 1987-1992 Framework Program for Research, Technology, and Development adopted in 1987 after months of arguments. The occasion is however a review of the program demanded by both the EC Commission and—for varied reasons—some member governments.

Observers in Brussels are already focusing on three levels of conflict: There is no doubt that the battle between the north and the south over the distribution of research funds, smoothed over with great effort at the time of adoption of the framework program, will flare up again. Also, in the matter of priorities for the 1990's and looking toward the turn of the century, the Commission has ideas for which it must find allies in the member countries. And, finally, the time has come to bring order to the complex relations between EC research efforts and the international research cooperative EUREKA.

The EC-internal north-south relations—first affirmed as a "partnership" with the entry of Spain and Portugal at the beginning of 1986—were put to the test for the first time during the discussions of the framework research program. "It boils down to a dictate against the disadvantaged member countries," stressed Iberian diplomats in Brussels during the haggling over content and funding of Community research efforts.

Cards Reshuffled in the Billion-ECU Poker Game

The EC Commissioner at that time, Karl-Heinz Narjes, had referred to the funding of the program just proposed under his leadership at approximately 10 billion European Currency Units (ECU = DM2.06) as the "absolute minimum." A few months later—weeks before leaving office—he spoke of the amount remaining as "sheer mockery": 5.4 billion ECU, with such restrictions that the Community now has available just over 4 percent of the amount spent annually for R&D by the national governments and their industry.

However, as a representative of highly industrialized northern Europe, even though he is a committed European, Narjes had little to offer in reply to the criticism that of the billions for EC research barely a two-digit percentage rate would reach the south. For the research policy "revision round," the Mediterranean countries—and Ireland—are reported to have more of an ally in the Italian Filippo Maria Pandolfi, the new EC Research Commissioner. Thus, it is possible that the cards could be reshuffled in the poker game for research grants from Brussels.

In an analysis of current EC R&D policy, the research policy spokesperson for the socialists in the European Parliament, Rolf Linkohr, has expressed sympathy for the new distribution: "Finally, by means of increased research, the countries in the Mediterranean region have hope of not missing the boat to the new age." In reality, the fact is all too often overlooked that Community research grants are an integral part of the whole package of structural funds to be used to level out Europe's north-south technological disparity.

Linkohr describes the current situation graphically: "Spain, Portugal, Greece, Ireland, and southern Italy must not continue to be the extended workbenches of northern companies."

The EC research framework program now up for interim evaluation and adjustment is divided into eight areas. It ranges from the relatively well-funded sectors of information and telecommunication technology to energy policy and biotechnology all the way to the areas trailing in research policy such as oceanography or environmental policy.

Space and Environmental Protection as New Priorities

Since the program's delayed entry into effect, the Commission in Brussels has hardly concealed its discontent

with this list of priorities largely dictated by the rich member countries. In the meantime, the cards have been reshuffled in this regard as well. Last year, the Commission signaled this with its ambitious proposal for an autonomous European space policy with remote earth reconnaissance to detect environmental damage as one of its priority projects.

The Commission thus sought and found solidarity with the European Space Agency ESA in an area which has been among its expressed priorities since the beginning of the year and which has also come up against decreasing objections in the ministerial meetings: In contrast to the situation just 2 years ago, an ambitious European environmental policy is advocated by almost all the governments.

Again, compared to 1987, the new Environment Commissioner Carlo Ripa di Meana—another Italian—enjoys "virtual free rein," as was already reported in his area with reference to his predecessor Stanley Clinton Davis who was called back to London.

Consequently, two representatives of southern countries have assumed key positions in both the north-south research policy conflict and the redefinition of priorities.

Regardless of how limited the financial basis for negotiations may now be in the wake of EC-internal financial reforms, there is no lack of cards to play in this game. They range from the assessment of activities in the biotechnology sector specifically requested by the German minister of research all the way to the research in the industrial sector called for by the south because of the urgent need to close the gap. Environment Commissioner Ripa di Meana can be played as the wild card with his demand for comprehensive environmental safety studies for research projects—which would inevitably lead to a debate about a permanent European system for assessment of the impact of technology.

And again in this area the Commission is in the best position, based on existing experience (FAST program [Forecasting and Assessment of Science and Technology]) and because of the divergent interests of the member countries. Acting skillfully, the Commission now clearly holds more trumps than it did 2 or 3 years ago when it drew so much criticism with its ideas about the European Technological Community. That culminated in the now infamous expression of former FRG Finance Minister Stoltenberg referring to the "EC Commission's intoxication with programs."

The strengthened position of the Commission will likewise necessarily play a significant role in the third foreseeable conflict about European research policy goals: the essential housecleaning in the relationship between EC programs and EUREKA.

Overlap of Various European Programs on the Agenda

Admittedly created to show even the EC projects up as bureaucratic and inflexible, the research cooperative was established on French initiative and with solid German support at its birth. "Market nearness" was supposed to be the central selection criterion for projects which would enjoy government assistance as a result of the EUREKA label. To date, the cooperative of industry, government, and the EUREKA administration has nearly 200 projects with differing participation to show for itself; its funding volume is roughly comparable to that of the EC research efforts.

However, the ideal of research cooperation in the stages just before production and with it the ideal of distribution of labor whereby the EC would be involved primarily with pure research fell into a gray area from the very beginning. The exciting concept that EC projects could be taken over as EUREKA projects as they neared the production stage—as envisioned by Xavier Fels, director of the EUREKA headquarters in Brussels—has not become reality. The programs occasionally overlap or seem to be virtually identical. And, from governments which originally unconditionally supported EUREKA funding, the call for a stronger EC commitment to EUREKA is growing; with projects such as JESSI (microelectronics), it appears that the EUREKA label would be eagerly exchanged for EC participation.

The EC-EUREKA dispute continues to be kept very low-key by all those involved, but it is not going unnoticed. According to observers, there is currently a clear majority in the European Parliament who support consolidation of EC research and EUREKA. There is the requirement of popular representation: EUREKA and its budget would have to come under parliamentary control.

EUREKA and EC under one roof.... That in itself would give a new character to Community research simply because of the increased mass. Research Commissioner Pandolfi has already made his position known: "A new strategy is urgently required from us to finally remedy a basic European weakness: The slow conversion of research results into industrial and economic success." The same song was sung at the cradle of the EUREKA program.

EC Vice President Comments on Research Strategies

MI890256 Turin MEDIA DUEMILA in Italian Apr 89 pp 6-12

[Interview with EC Vice President Filippo Maria Pandolfi by Giampiero Gramaglia: "Pandolfi: European Interest in Research"]

[Text] Brussels—Having the right cards to play in 1992 and dealing them out in such a way that will make Europe more competitive on the world scene: Filippo Maria Pandolfi, vice president of the European Commission responsible for research, computer technology, and

telecommunications, has a clear idea of his own role as well as specific projects. In this interview with MEDIA DUEMILA he explains the decisions he is going to make.

[Question] The most important task of the Commission, which will remain in office until 1992, is to complete the preparations for the single European market. The key positions would therefore seem to be those relating to this task. Italy, on the other hand, has requested and has been assigned, a task which goes beyond the launching of the single European market. What was the reasoning behind this choice?

[Answer] To date, the process that will lead to the creation of a single market within the European Community has centered primarily on the definition of new ground rules. The dismantling of technical barriers involves, for example, modifying long established rules, both for liberalization and standardation purposes. These are the classic aspects which come under the jurisdiction of the so-called portfolio of the internal market.

Similarly, there will be changes in tax regulations. I refer to the types of taxation that most directly affect the free circulation of goods, people, services, and capital.

Naturally enough, during this initial phase of work for the definition of a single market, less emphasis has been placed on another aspect that is intrinsically linked to this new dimension of the European Community: not the rules of the game, but the game we will be able to play with the new rules.

The single market could become a new entity on the world map. This would represent a tremendous step forward if compared to the fragmented map that Europe was, and still is to some extent, because we are only half-way there. Paradoxically, however, this could lead to a reduction in the importance of this new area in the world as a whole and, at a more technical level, in its competitiveness on the world market.

This is where I come in, working more on the game itself than on the rules of the game. What this means in practice is that while the work of dismantling the physical, technical, and tax barriers continues—the path is still strewn with obstacles, and a major political effort is still necessary—we cannot afford to waste a single day in our efforts to create conditions that will enable the new system to be more competitive at the international level.

It is not enough to eliminate the technical barriers between one country and another if companies still have a nationalistic approach to business rather than a supranational one. The world is moving forward and other markets are not going to stand still and wait while we create a single market.

[Question] In which areas of research and industry must Europe improve its position?

[Answer] I will take as an example a sector that has evolved into a system because technological progress has dismantled the barriers between the various fields involved. This is the IT [information technologies] sector, which ranges from microelectronics, that is, integrated circuits and the latest generation of chips, to complex telecommunications systems and all areas of computer technology.

The stakes in this sector are enormous: we need only say that by the year 2000, 60 percent of the working population will be involved in information technology sectors in one way or another. This is a form of "perfusion," a term I have borrowed from French Research Minister Hubert Curien, which means a combination of diffusion and penetration at all levels of the economy.

This entire sector is changing constantly and the challenges are enormous. For example, will there still be room for Europe in the manufacture of highly advanced integrated circuits or will Europe abandon this sector? Today the sector has three manufacturers: Philips, with sales of over $8 billion, SGS-Thomson, a major Italian presence with sales of $1.2 billion, and Siemens, with sales of $0.8 billion. This is an important question: if we fail to stay in this market, will we become large consumers of chips manufactured by Japan or the United States or by both of these countries?

[Question] Defining the rules of the game and dealing the cards will be the two major areas of EC activity between now and 1992. What are the points of contact between the two?

[Answer] These processes are developing simultaneously. If we are to give an industrial dimension to the single market, we must take particular advantage of the liberalization that is taking place in the computer technology and telecommunications sectors, and which is dependent on the rules of the game.

[Question] If we look at research and new technologies at the world level, is Europe in a position to hold its own against the United States, Japan, and the developing countries?

[Answer] In some advanced sectors, unfortunately, the barometer of EC competitiveness at the world level gives negative and, in some cases, worrying indications. However, I have a card up my sleeve: the first paragraph of a section of the Treaty of Rome, the EC "Constitution," which has been taken from the Single Act and which finally provides a clear definition of the EC's responsibilities in terms of technological research and development. It establishes two objectives: first, to strengthen the scientific and technological bases of European industry, and second, to make European industry more competitive internationally. These are therefore the ultimate objectives of our work.

Unfortunately, many advanced sectors are not becoming more competitive. On the contrary, there are indications that these sectors are at risk, even severely at risk. This cannot be attributed solely to inadequate research but also to the small size of European companies, the fragmented nature of the markets, the reluctance to see

Europe as a domestic, rather than a foreign market, and finally, the lack of ties between companies.

This is also due to factors outside the sector for which I am responsible. However, this sector will be a means of improving competition in the strict sense of the term on other fronts.

[Question] In your opinion, what is the most important result achieved so far by EC initiatives in research, computer technology, and telecommunications?

[Answer] Everyone recognizes the great success of programs such as ESPRIT [European Strategic Program for R&D in Information Technologies]. The success of ESPRIT does not lie in the amount of research generated by the program but in the fact that European companies have now filled their formerly empty agendas with a list of European contacts. Companies are now finally working together and have an opportunity to establish new ties.

[Question] Is the creation of a European working environment more important than the financial incentives offered by EC programs?

[Answer] In absolute terms, EC funding is small compared with the funding required for research. For example, the United States spends $120 billion a year on research, whereas Europe as a whole spends $80 billion. EC financing amounts to approximately $1.5 billion, a small portion of the $80 billion.

To use an expression by Etienne Davignon, this small sum is a form of authorization; that is, it authorizes us to coordinate, to promote joint initiatives, and it authorizes companies to feel that they form part of an overall plan. As a result, there are a great deal of spin-offs on the industrial economy's natural evolution process.

[Question] Is it really true that in this context Italy is the black sheep of EC research? Are Italian expenditures inadequate and unsatisfactory?

[Answer] First of all, we must remember that expenditure for research in Italy has increased from 1.1 to 1.5 percent of GNP according to the 1987 figures. Secondly, research in general, but particularly Italian research, has become more European. This is a positive aspect even though research at the European level may have become fashionable or a question of image or culture.

Italy has some strong points and it is not true that the country is a sort of province inhabited by small- and medium-sized companies. On the other hand, what counts for Europe counts for Italy; we cannot do things alone. This means that everything depends on our ability to establish ties.

[Question] If we are to strengthen the network of contacts between European companies and become more competitive, can European research and programs for new technologies remain at the precompetitive level, or must they go beyond this point?

[Answer] In Brussels, we must certainly support basic research, which by the way is not even very expensive. This type of research has its own rules. You must lay the foundations for basic research, and if this is not done, you have major problems because people are already wondering about the results.

It is clear, though, that we have to pay attention to the Treaty of Rome, which states that there must be a spin-off in terms of competition.

After the review of the 1987-91 program, which will really come into its own in June, I would like to shift the focus of attention a little. In relation to the first objective, I would like to place the emphasis on feasibility studies, demonstration projects, and pilot projects, because one of the things I would like to do is reduce the amount of time that elapses between carrying out applied research and reaching the market. If 3 years are spent in this process, we lose money and resources belonging to the EC and to all the companies involved.

[Question] Does this means that the relationship will have to be redefined with non-EC programs that are broader in scope and subject to fewer limitations?

[Answer] If we look beyond the borders of the EC, we have EUREKA [European Research Coordination Agency], which has a more flexible formula and goes as far as the precompetitive phase, bringing together companies from non-EC countries, such as the EFTA [European Free Trade Association] countries. Now we are all aware that despite all these positive aspects EUREKA has had, and is still having, difficulty in taking off. One of the strengths of the review of the program is that it will give priority to synergies between our programs and those of EUREKA.

What is the reason for this? Among other things, it is one of the stipulations of the Treaty of Rome, in a little known article of the Single Act dealing with complementary programs or in other words, programs conducted with some, rather than all of the 12 member countries, and where the form of participation is defined case by case. By doing this, we broaden the horizons of our activity to penetrate deeper within certain "sanctuaries" of the industrial economy of the 21st century.

[Question] Does this mean that your work as head of research in Europe has two objectives, to go beyond the precompetitive level and to broaden cooperation among companies at the international level?

[Answer] Look around us: in the United States, which is a single nation and where problems of competition between states do not exist, federal aid to research can include the competition phase. We in the EC, on the contrary, stop at the precompetitive phase, but at least we can take advantage of the projects under the EUREKA program. I do not want to return to legal constraints now that they have been abolished by the Treaty of Rome; on the contrary, I want to take advantage of a "Single Act Europe" as it comes to life, in all its

vitality, a Europe that is not restricted to the 12 member countries alone. It is essential that we do not miss out on opportunities because of a form of legal screening that is meaningless in this field. This does not consider the fact that the opening of the borders will cancel any fears people may have of a "fortress Europe" in 1992.

[Question] Computer technology is a sector in which European industry is weak. Telecommunications, on the other hand, is a strong sector. Will different strategies have to be adopted at the domestic and international level if we are to strengthen our position in the first sector and maintain our position in the second sector?

[Answer] The same strategy must be adopted in both sectors; I do not believe that there should be any difference in approach. Everything depends on the strength of companies today and on the ability to take initiatives and to create joint ventures, establish collaboration between companies, and reorganize companies. We have to bear in mind that the "map" of companies in this sector is going through a period of widespread change.

The market structure in this sector means that the supply side will have to be increasingly ready to adapt at all times. Growth in demand tends to be diffused, with a basically constant growth pattern, based on growth in GNP and personal income. Supply is characterized by a lack of continuity, and is influenced by connections, interrelations, and at times, by areas of concentration.

[Question] Is the Commission, as well as the governments of the 12 member countries, prepared to follow the path you have described?

[Answer] There is one strong point in my statement. The things I am saying are being said by President Jacques Delors. The good working relationship that I immediately established with the president has been of great benefit to me. Delors provides support for the work I do, as does the Commission as a whole.

When working at the government level, you have to be careful to avoid the trap of oversimplification. All my work is conducted at the political level, with the aim of overcoming certain prejudices. But these prejudices must be overcome by truth. You must have the patience to explain things.

I have visited the capitals of the EC and while it is clear that each nation has its own way of seeing things, I believe that we all agree on one point, which is that Europe must become more competitive. People talk about a European society, but employment and unemployment depend on our ability to compete internationally.

[Box p 9]

Filippo Maria Pandolfi's European Role

Since January this year, Filippo Maria Pandolfi has been presiding over European policy in research, telecommunications, and new technologies. Pandolfi is 61 years old, a Christian Democrat, former minister of the treasury, industry, and agriculture, and the successor of Karl-Heinz Narjes from the FRG in the new EC executive branch. Most importantly, however, he has inherited the portfolio held by Etienne Davignon in the early 1980's.

"Making his debut" in Brussels as vice president of the European Commission, Pandolfi is an expert in EC affairs. As minister, he was president of the EC Council and has taken part in dozens of meetings. In the executive branch he is accompanied by another Italian, Carlo Ripa di Meana, reappointed for a second 4-year term (Lorenzo Natali, on the other hand, has returned to Italy after 12 years in the EC).

Pandolfi has been a member of the Italian parliament since 1968, and has always been the first in order of preference in the elections for the seat of Bergamo and Brescia since 1976. He has a degree in philosophy and is married with four children. Pandolfi's role is an important one. He must ensure the competitiveness of Europe's leading-edge sectors in preparation for the launching of the large internal market—the single European market—by 1992. Jacques Delors, the appointed president of the European Commission, has faith in his ability to carry out this task.

The political resume of Pandolfi who, in private life, is also an executive in a publishing company, includes details of his appointments as undersecretary for finance between 1974 and 1976, and subsequently as minister in three governments between 1976 and 1988. He was president of the International Monetary Fund's Interim Committee between 1979 and 1980.

The EC matters in which he was involved during his term as minister include the introduction of VAT [Value Added Tax], the creation of the EMS [European Monetary System], the reorganization of the steel industry, the energy crisis, and the reform of the common agricultural policy. His knowledge of foreign languages, a rare asset in Italian politicians, ensures him easy access to the European scene.

[Box p 10]

High Definition Television for the 1990 World Cup?

It now seems that European "television without frontiers" is really starting to have common rules, which were outlined by the ministers of the 12 EC countries in March. Pandolfi is consequently more hopeful that the 1990 World Cup in Italy will provide an opportunity for live testing of European HDTV (High Definition Television) technology. The vice president of the Commission intends to work toward this end.

He has already mentioned this to the EC Council of Ministers, the industrialists involved, and to journalists. Time is running short if HDTV is to be successful, as the future world standard is due to be chosen next year. The system born of the collaboration between Philips, Thomson, Thorn-EMI, and Bosch under the EUREKA program, and including a project in the RACE [Research

and Development in Advanced Communications Technologies in Europe] telecommunications program, is competing against the Japanese system MUSE [Multiple Sub-Nyquist Sample Encoding]. The MUSE system was used by RAI for Peter Del Monte's film "Giulia e Giulia" and tested during the Seoul Olympics.

The response by governments of the 12 member countries has been positive, despite some hesitation on the part of Italy. The reason for this is that Italy has made only a small contribution to the EUREKA program's Project 95 on HDTV development, and the fear that "private operators" will win a march over televisions based on the European system by buying Japanese.

Pandolfi commented on the use of the Japanese system by European television such as RAI and the BBC, which is producing a program in four parts using MUSE. Pandolfi understands that "when faced with a long-term objective, all the new technologies available on the market should be taken into consideration: it is a fight against time." Tests during the 1990 World Cup and during the events planned in Spain for 1992 (the Olympics and the 500th anniversary of the discovery of America) "will depend on what the Europeans manage to do" this year.

In technical terms, HDTV, the European system of high definition television, is ready. We must now provide more equipment and make the system compatible with existing systems (an advantage that this system has over MUSE, which "breaks" with present technologies, for a complete changeover of worldwide television systems). In the United States, AT&T and Zenith have stated that they are interested in this field, but they are late starters and the gap will be difficult to bridge.

A group of representatives of the CCIR (International Consultative Committee for Radio and Television) met in Montreux, Switzerland in May to assess the progress made toward HDTV systems.

According to European, American, and even Japanese experts, the MUSE system—1125 lines per 60 Hz—is of a lower quality than the European system—1250 lines per 50 Hz. An additional disadvantage is that it is not compatible with the color television systems currently in use. According to Pandolfi, "1989 will be a crucial year for HDTV. We have a clear and ambitious objective, that is, the formal recognition of the European system as a world standard." This is a market which in the coming years will be worth 200 billion ECU a year, over 300 trillion lire, divided equally between equipment and programs.

The recognition of the European system is not the only challenge that will have to be faced this year. The 12 EC members must approve the policy of television without frontiers, and in July the regulations concerning economic groupings at the European level will come into force. One of these regulations, which covers the promotion and marketing of HDTV, will bring a number of industries together. A contract with Philips, Thomson, and BTS has already been approved.

Pandolfi believes that four obstacles must be overcome in connection with European HDTV: laboratory and mobile technology, decoding equipment, receiver sets, and satellites. Pandolfi also foresees synergies between EC research programs and the EUREKA program, which brings together 19 European countries and the Commission. An example of this is HDTV itself, which was originally conceived within the framework of EUREKA and is supported by RACE.

Italian-French Research Association Established

MI890255 Milan ITALIA OGGI in Italian
18 Apr 89 p 15

[Article by Albert Toscano: "A Bridge Between Italy and France for Cooperation in Research"]

[Text] AFIRIT, the French-Italian Association for Technological Research and Innovation, was officially set up in Paris on 18 April. The decision to establish the association was made by Ciriaco De Mita and Francois Mitterand during the Italian-French summit held at Arles last October. The scientific research ministers from the two countries, Antonio Ruberti and Hubert Curien, immediately drafted and signed the new organization's protocol of association. A meeting was held in Paris on 18 April to appoint the members of the board of directors. The position of chairman will be assigned to a Frenchman, and Orio Carlini, an Italian, will be the secretary general.

The meeting was attended by Italian and French scientific research ministers and by representatives of the companies most involved in technological innovation and applied research in the two countries.

The manager, Pasquale Pistorio, who is the symbol of successful Italian-French industrial and technological cooperation at the international market level, also took part in the meeting. Pasquale Pistorio joined SGS-Thomson after having served as a top manager for Motorola, the American corporate giant in the field of semiconductors. He is now president of the SGS-Thomson Microelectronics group which was established in 1987. The objective of this company is to promote Italian and French public industry in the field of electronic components. At the same time this will enable industry to reach the critical size necessary to finance far-reaching research programs and to survive in a market dominated by Japanese and American corporate giants.

Pistorio has repeatedly stated that there will be room for only two kinds of business enterprises in the microelectronics industry of the future. They should be either very large companies or the highly specialized companies that occupy the "niches." The establishment of the new group enabled SGS and Thomson to jointly achieve results that

neither company would have been able to achieve separately. This success shows how much the Italians and French can achieve in the international market by sharing industrial resources and technological know-how.

The magic word is "synergies." AFIRIT's objective is to give the word a concrete dimension by assisting Italian and French companies in making agreements which can give rise to a process of technological innovation. This would prove much more difficult if each company were to do this itself.

The EUREKA [European Research Coordination Agency] project and the EC as a whole are engaged in promoting technological cooperation between companies along international lines. In the case of the small- and medium-size enterprises however, the problem is facilitating access to the financial resources that are allocated to stimulate research and combine research efforts with industry. Here, too, AFIRIT can play a major role as an organization specifically designed to improve cooperation between Italy and France.

AFIRIT's members include the Italian and French Ministries of Foreign Affairs, the Italian CNR [National Research Council], ENEA [Italian Committee for R&D of Nuclear and Alternative Energies], and corresponding French organizations, all of which were represented at the Paris meeting. This was the first meeting attended by representatives of the two governments and by organizations and industries involved in the new Italian-French association.

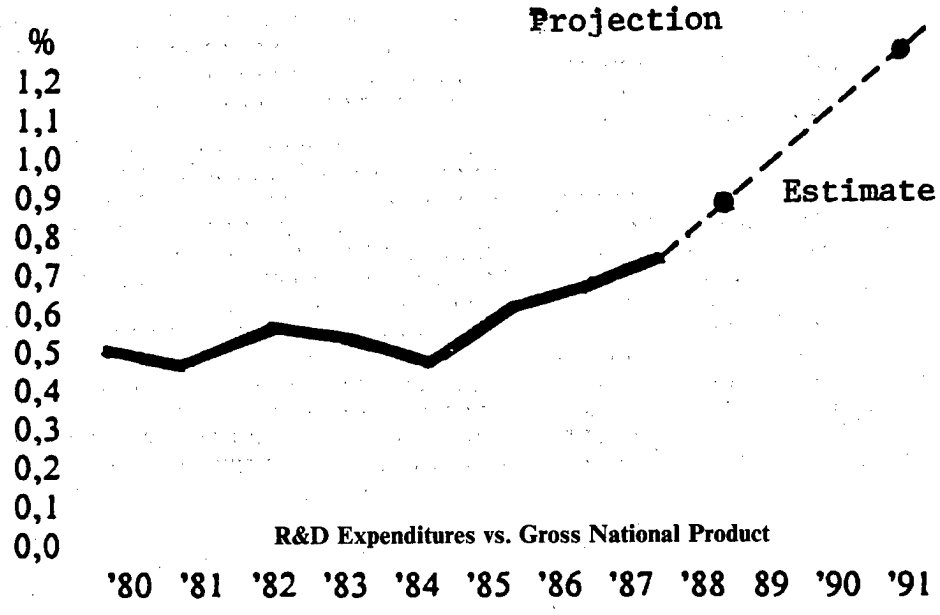
Spain's R&D Plans Described

36980152 Paris AFP SCIENCES in French
16 Feb 89 pp 2-4

[Article: "Spanish Research: 'Below the Reasonable Level'"]

[Text] Paris—Spain, which devotes 0.85 percent of its gross domestic product, or Fr3.7 billion, to research and development, "is still "below the 'reasonable' level which one might expect, but the budget for this sector keeps increasing rapidly," the Spanish secretary of state to universities and research stated on 10 February in Paris. Although this budget accounted for only 0.5 percent of the gross domestic product in 1983, it is expected to reach 1.2 percent in 1991, Mr Juan Manuel Rojo Alaminos indicated at a conference on the Spanish scientific research and technological development policy.

Currently, Spain allocates 530 million ECUs [European Currency Units] to research: 26 percent to basic research; 13 percent to health; 28 percent to information and technologies; 14 percent to agriculture and the agrifood industry; and 17 percent to training. France, whose goal it



R&D Expenditures vs. Gross National Product

is to devote 3 percent of its gross domestic product to research, is spending Fr42.3 billion on it this year.

One of the Spanish government's priorities is to improve "the training of young researchers"; they number barely 35,000, "that is half as many as the average for OECD countries", the secretary of state went on. "In addition, young graduates often prefer to accept offers from the industry instead of university grants, which are judged inadequate. An important step was made during the past year with the creation of a fund managed by an interministerial commission, to coordinate research activities," the secretery of state indicated.

There are some 900,000 students in the 30 Spanish universities which, according to Mr Rojo, "do not collaborate enough with the industrial world." Yet, a joint training program for young researchers was started this year by corporations and the Madrid and Barcelona polytechnic universities.

The Largest Spanish National Laboratories

Name and Discipline	Supervising Ministry	Personnel	1987 Budget (Millions of ECUs)
CSIC (all disciplines)	Education and Sciences	7,000	220
IAC (astrophysics)	Education and Sciences	100	6
CIEMAT (energy and environment)	Industry and Energy	1,420	48
ITGE (mines and geology)	Industry and Energy		30
INIA (agriculture)	Agriculture and Fisheries	1,200	
IEO (oceanography)	Agriculture and Fisheries	400	16
INTA (aeronautics and space)	Defense	1,500	30
CARLOS III (Health)	Health and Consumption		48

Key:
CSIC: Higher Council for Scientific Research
INIA: National Institute for Agrarian Studies
INTA: National Institute for Aerospace Research

FRG: BMFT Subsidizes R&D at Technical Universities

MI890258 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 500, 31 Mar 89 pp 2-3

[Text] During research policy talks at a meeting held by the Ministry of Education and Cultural Affairs in Bonn, Research Minister Riesenhuber highlighted the BMFT's particular interest in supporting research at the university level. The problems that technical universities will face in teaching and training young scientists, especially in the 1990's, are partly of a structural nature (lengthy courses and examination times) and fall under the Lands' complete responsibility, partly demographic, and partly of a nature requiring the support of the Federal Government.

The Research Ministry supports the research activities of German technical universities by subsidizing specific areas of basic research, primarily through targeted project financing. Universities contribute significantly to the completion of BMFT programs and to basic research by developing key technologies for industrial innovation, carrying out preventive research and long-term programs such as oceanography and polar research or space research and technology. The BMFT allocates an annual DM100 million to special areas of basic research. Industrial research carried out jointly with universities doubled between 1984 and 1988, totaling more than DM100 million annually. The BMFT also subsidizes genetic engineering centers and other priority programs in biotechnology in which technical universities and nonacademic organizations cooperate.

Between 1986 and 1988 the funds allocated to FRG universities to support activities in key technology sectors and in the area of preventive research and to enable them to take part in long-term programs increased as follows:

Key technology sectors:

- Materials research (1986-1988) +65 percent
- Computer technology +65 percent
- Biotechnology +45 percent

Preventive research:

- Environmental and climatic research (1986-1988) +38 percent
- Health research +15 percent
- Work and technology +14 percent

Participation in long-term programs:

- Geosciences, oceanography, and polar research +18 percent
- Space research and technology +7.5 percent.

All these contributions are expected to create employment equivalent to over 5,000 man-years.

Over the past few years the BMFT has invested more than DM3 billion in large-scale research equipment for national and international organizations, including instruments for the LEP [expansion not provided], the world's largest accelerator at CERN [European Organization for Nuclear Research] in Geneva, the HERA [expansion not provided] accelerator at DESY [Foundation of the German Electron-Synchrotron] in Hamburg, the SIS [Heavy Ion Synchrotron] at GSI, the Society for Heavy Ion Research in Darmstadt, the ROSAT X-ray satellite, and the research satellites Meteor II and Polarstern; university research teams use up to 80 percent of these instruments. Finally, there is the successful Leibniz Program, carried out jointly with the BMBW [FRG Ministry of Education and Science]. In 1988, 36 of the 44 grants assigned under this program went to university researchers. The BMFT's program "Research Cooperation with Industry" has led to an increase of research personnel in universities: 510 out of 760 cooperation projects were carried out with universities.

In order to promote teaching opportunities in German technical universities and the training of the young scientists, the BMFT has been intensively supporting cooperation between 13 large German research institutes, the Fraunhofer Society, the Max Planck Society, and German technical universities. Yet Riesenhuber still feels that additional lectureships at German universities could be offered to the scientific personnel of large research institutes, the Fraunhofer Association, and the Max Planck Society. So far, this has frequently been hampered by administrative problems (capacity regulation, legal compensation problems, etc.). The BMFT is ready to provide support if the Lands consider it necessary. Riesenhuber's proposal is to set up a joint working group to assess the existing potential and to help German universities overcome the current standstill.

SUPERCONDUCTIVITY

FRG: Hoechst, Siemens To Cooperate in R&D

MI890257 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 500, 31 Mar 89 pp 12-13

[Text] Hoechst and Siemens carry out joint research and development activities in the area of high-temperature superconductors. The two companies, which have signed an agreement expiring at the end of 1990, are in the forefront of high-temperature superconductor research in the FRG.

Siemens' affiliated companies Interatom GmbH and Vakuumschmelze GmbH and Hoechst's CeramTec are also involved in these activities. More than 100 scientists and technical experts are working on this joint project which focuses on applications-oriented basic research in the area of high-temperature superconductors. The major objective is to develop new superconducting materials and manufacturing processes for conducting structures, as well as to improve coating techniques.

High-temperature superconductivity is regarded as a key technology worldwide. The first technical applications are expected to be in the fields of electronics and sensors, and later in the area of energy technology.

The scientists of both companies involved in the project meet regularly to report on research results and findings and to coordinate objectives and common working programs. The exchange of collaborators is also envisaged.

At a later date, each of the companies involved can exploit the results of this basic research cooperation to compete at an international level.

The Siemens and Hoechst joint research program is carried out by competent scientists working in technical universities and government-supported research institutes within the framework of BMFT projects.

Italy: New Applications for Superconductors Presented

MI890251 Milan ITALIA OGGI in Italian 18 Apr 89 p 10

[Text] High-temperature superconductor materials are already finding their first practical applications only 1 and ½ years after their discovery.

One such application was presented by CISE [Center for Data, Studies, and Experimentation] of Milan, the Enel-related laboratory which was among the first to carry out research in the field. The CISE stand at Milan's April Fair, is exhibiting a model of a frictionless, high speed magnetic levitation bearing which uses the properties of the new superconductors.

The characteristic of these materials (the bearing is made of an Yttrium Barium Copper Oxide ceramic) is that below the temperature of liquid nitrogen, which is -196° C, not only do they offer no resistance to the passage of electric current, but they also repel magnetic objects (Meissner effect).

This property can be used in the development of high speed bearings with no mechanical friction. In CISE's demonstration model, a rotor with two magnetic ends fluctuates above two liquid nitrogen-cooled superconductor bearings. An airflow then keeps the rotor in constant rotation.

Possible industrial applications for this kind of superconductor bearing may include precision mechanics, electronics, and computer technology (just think of the degree of accuracy and speed required by current magnetic or optical disk storage systems), as well as the space industry and the medical sector.

BIOTECHNOLOGY

Romania: New Process for Methanol Conversion Developed

23020072p East Berlin KERNENERGIE in German May 1989 p xviii

[Text]After many years of research, experts from the Institute for Chemical and Biological Energy of the Central Institute for Chemistry in Bucharest have put into operation a process for manufacturing hydrocarbons on the basis of cellulose. The process, already included in a pilot project at the Brasov Petrochemical Combine, uses wood chips and shavings as raw material, transforming them by means of distillation into methanol.

Using synthetic catalysts (zeolites), methanol can be processed into either olefins and aromatic hydrocarbons or benzine [Note: This is a light distillate that is commonly used as a solvent. It should not be confused with benzene]. What is special about the process and the facilities required for it is that the methanol is fully transformed into so-called clear products such as benzine and gases, yielding an aqueous solution with weak traces of alcohol as a by-product.

In collaboration with biologists from Iasi, the experts from Bucharest managed to "feed" the resultant solution to certain bacteria which transform it into feed protein. This new process for biologically transforming methanol represents an international-level innovation.

COMPUTERS

GDR's Leipzig Fair 1989 Reviewed

23020065 East Berlin NEUE TECHNIK IM BURO in German May-Jun 1989 pp 65-67

[Article by Dipl.-Phil. Sibille Jaab, Dipl.-Eng. Peter Kowollik, and Eng. Bruno Preisler: "Leipzig Spring Fair 1989"]

[Text]

Computer Technology Everywhere

Everywhere that cutting edge technology was displayed, computer technology was also found in one form or another.

Computer technology from Robotron was not merely to be seen in many booths, but was also sold to numerous countries. The Robotron Export-Import VEB was able to conclude agreements with the following partners, among others:

- Elektronorgtechnika/USSR ordered for 1989-90 32-bit computers, and 16-bit personal computers as well as memory technology and peripheral devices,
- KOVO/CSSR purchased for 1989-90 EC 1057 data processing systems as well as EC 1834 personal computers and will deliver EC 1027 electronic data processing systems,
- Metrimpex/Hungary is importing in 1990, in addition to small mechanical typewriters, other Robotron typewriter technology and will deliver electronic measurement technology,
- Isotimpex/Bulgaria ordered for 1990 electronic measurement technology, including 25 fault-location vehicles for testing cables and locating faults in cable networks,
- Sovelektro/USSR ordered for 1991 a total of 100 such fault-location vehicles.

Four Gold Medals for Robotron

Robotron's successes in electronic measurement technology, among other things, came not only in exports, but also in the gold medals from the Leipzig Fair Authority. Receiving gold medals were

- the Robotron M 4202 partial discharge probe for detecting fault locations in high-voltage insulators,
- the Robotron K 6416 compact plotter (cover illustration),
- the Robotron A 5105 educational computer (presented in the previous issue),
- the Robotron "color-vision RC 9140" portable color television receiver. This television set also received an award for good design.

Important Press Conference of the VEB Robotron Combine

At this international press conference, it was announced, among other things, that in 1988 Robotron produced 534,800 typewriters 57,400 personal computers, 175,000 disk drives, 113,000 printers, and more than 300,000 radios and televisions.

More than two-thirds of Robotron's products and services are exported to over 60 countries of Europe, Asia, Latin America, and the Near East.

Joint GDR and USSR Enterprise

At this press conference, in which 87 journalists participated, and in an interview with VEB Robotron Combine's director-general Friedrich Wokurka, the newly founded joint German-Soviet enterprise ZENTRON aroused special interest.

At the beginning of the fair, GDR Minister for Electrical Engineering and Electronics Felix Meier and USSR Minister of Instrument Making, Automation Equipment, and Control Systems Mikhail Sergeyevich Shkabardnya signed on behalf of their governments an agreement on the founding of the "Joint Scientific Production Center for Development, Delivery, and Maintenance of Software and Data Processing Systems ZENTRON."

This enterprise's function is the development of country-specific user programs, primarily for electronic data processing systems, superminicomputers, and personal computers of the VEB Robotron Combine. The company will be headquartered in Kalinin and employ 200 workers, primarily citizens of the USSR.

Robotron will equip the company with ESER systems, 32-bit computers, personal computers, and peripherals.

ZENTRON's founding reflects the increasing significance of software production in the application of modern data processing, i.e., the Soviet customers are offered system performance as well as high-quality customer service. User training is also relocated closer to Soviet customers.

Flexible Automation

The VEB Robotron Combine and prominent users responded to this theme of the Leipzig Spring Fair 1989 in exhibit halls 15, 18, and 20, among others, with a demonstration of computer integrated manufacturing (CIM) of printed wire boards, electric motors, and mechanical engineering products.

The three complexes were networked as if they were different sections of an enterprise. The RVS Robotron K 1840's operating respectively in halls 15 and 20 as central computers were linked to each other and had their own data banks. The "electric motors" project in hall 18 was connected to the complex in hall 15 via ROLANET1.

The electrical engineering/electronics industrial sector demonstrated CAP workstations for operations management, planning, complicated preparations for production, accounting and control, technological application of production planning as well as product inventory. From the hardware standpoint these workstations were implemented using EC 1834 personal computers and Robotron A 7150 workstations. The Robotron A 5230 operations data system with K 8915 data stations and K 8902 operations data terminals was used for monitoring and evaluating the production process and its progress as well as for monitoring working time and inventory.

In the "electronic subassemblies" production line, the following CAD/CAM workstations were presented:

- circuit design with the Robotron K 8919.11 interactive graphics terminal (This new development was presented in the preceding issue.)
- component research for data preparation for printed wire board design
- printed wire board design on the EC 1834 personal computer
- printed wire board assembly with the PHM 55 industrial robot, which may be used for processing both pass-through and surface-mountable components
- the P 3040 printed wire board tester
- the RaB 10 repair workstation for printed wire boards with surface-mountable components.

In the production lines for electromechanical and mechanical subassemblies including portions of the "electric motor production" area, the following workstations were used:

- EC 1834-based technician and design workstations
- A 7150-based programmer workstations for the F250/1 flexible production system
- process-master computer/cell computer from the VEB Automated Industrial Plant Construction Combine with the ICA 710.30/710.20 industrial computer; as a concrete control task, an excerpt from the production cell "Processing Center Rotation" FC CDXF2-CNC with IR 2P and palette key station was demonstrated.

In a software applications center, off-the-shelf program systems for CAD/CAM applications on the EC 1834, the A 7150, and the P 8000 compact were demonstrated by the Robotron, Electronic Apparatus Works, and Data Processing combines and the Academy of Sciences.

Communication between the individual areas and workstations took place on several levels:

On the processing level, production control by the ICA 710.30/710.20 industrial computer and MRS 705 and S 2000 control were implemented via a serial interface. Communication on the operations level was based on the ROLANET1 local area network.

Long-distance communication and connections to the public network were handled by the VEB Communication Electronics Combine's NZ400D extension board, which was connected both to the star network of the RVS K 1840 and to ROLANET1 (via a router based on the Robotron 1715 personal computer).

The subassemblies for flexible automation demonstrated in hall 20 by the machine tool and tool industry included the following processes:

- production development
- inventory projection
- technological preparation for production
- production planning and production process control.

Here again, the hardware base consisted of the EC 1834, K 8919.11, and ICA 710. Sector-oriented CAD/CAM software for machine tool construction operations was demonstrated.

The EC 1834 personal computer favored for use as a workstation was displayed in a typical configuration with an K 1810WM87 coprocessor, a 640-Kbyte RAM, monochrome alphanumeric screen, color monitor, two disk drives, one 50-Mbyte hard disk, a K 6314 matrix printer, a K 6405.04 graphics tablet, and a Sekonic SPL

430 plotter. Basic software used consisted of the DCP 3.3 operating system, the DCPNET network software (ROLANET-connection), and DCS/DCP (for serial connection).

Standard software demonstrated included:

- REDABAS-3: databank system for personal computers
- AIDOS DCP: information research system
- TEXT 40 K: German/Russian text processing program
- NUMATH-1 DCP: program system for numerical mathematics
- STAVE: program system for statistics.

Local Area Networks (LAN's)

The local area network ROLANET1 already mentioned was the most efficient of the three LAN's displayed in the VEB Robotron Combine booth. It is a universal heterogeneous LAN and permits connection of

- Robotron A 5120/A 5130 office computers,
- Robotron 1715 and 1715 W personal computers,
- K 1630-based computer systems,
- Robotron A 7150 workstations,
- EC 1834 personal computers,
- Robotron K 1840 RVS,
- EC 1055/1056/1057 data processing systems.

ROLANET1 characteristics: Bus topology: linear Bus cable type: coaxial cable Bus length: a total of 1,000 meters Number of stations connectible: maximum 254 Access procedure: CSMA/CD Data transmission rate: maximum 500 KBS Connection of stations to bus via:

- Robotron K 862X LAN controller (Each type of computer needs its own LAN controller, usually in the form of a card.)
- Robotron K 8601 transceiver (same type for all stations).
- The EC 1055/1056/1057 systems are linked to the LAN via an EC 1834.

See [bibliography entry] [1] for information concerning ROLANET1 software.

The newly developed LAN EC-NET was presented as a special application of ROLANET1 with only EC 1834's connected. With this restriction, the characteristics of EC-NET are the same as those of ROLANET1. The technical homogeneity of the network permits simpler software.

The SCOM-LAN local area network developed by the IH for Navigation Warnemuende/Wustrow connects

- A 5120/A 5130 office computers,
- Robotron 1715 and 1715 W personal computers, as well as
- EC 1834 personal computers.

SCOM-LAN characteristics: Bus topology: ring Bus cable type: coaxial cable; optical fiber possible Bus length: limited by maximum distance of 600 m between 2 stations Number of stations connectible: maximum 99 Access procedure: contention (with collision detection) or random with priority assignment Data transmission rate: maximum 153 KBS Connection of stations to bus: via individual net-interface units for each computer type, designed as cards.

The SCOM-LAN was also demonstrated with integrated directional radio technology, i.e., the bus consisted in part of a directional radio link made up of two PCM 10-300/400/800 digital directional radio units from the VEB Robotron Combine as the terminals of the directional radio link. In this way, with a directional radio link, distances up to 50 km can be bridged.

Robotron A 5240 Time and Access Control System

This system, previously constructed with the Robotron 1715 system [bibliography entry 2], was enhanced for time and access control for up to 5000 persons by integration of the EC 1834 with a hard drive.

Up to 14 terminals may be connected to the A 5240, such as

- system terminal (Requires one in the system, for encoding the magnetic cards to be read by the magnetic card readers of the other terminals, among other things. Encoding is carried out using the K 6501 write-read unit.),
- access terminal (turnstile),
- security terminal (additional 10-key pad),
- gate terminal.

The A 5240 system

- records in- and out-times,
- calculates the time present,
- reports the times absent sorted according to reasons, and
- individually controls access authorization to sensitive areas.

Robotron K 6416 Compact Plotter

The K 6416 is a drum plotter for A3/A4 graphics formats, with a plotting speed of 300 mmps and a resolution of 0.1 mm.

Plotting tools used are ink pens with fiber or plastic points and stenciling pens. The pen carrousel can hold eight plotting tools of different colors or line thicknesses for program-controlled exchange.

Twenty different character sets are available for lettering on sketches and graphics.

Both white and transparent plotter papers, as well as plotter films including projection films, can be used for multicolor sketches. The paper drum, the pen carriage, and the pen magazine are driven by step motors. Using the 14-Kbyte data buffer, a large part of the graphics to be plotted can be immediately transmitted in full from the computer to the plotter, freeing the computer for the next task during plotting.

Interface variations (serial): RS232C/V.24, IFSS.

The K 6414 is compatible with international broad-distribution personal computer plotters.

Knitting Pattern Design With the EC 1834

An EC 1834 with

- a special camera linked to the image storage of the EC 1834,
- a color monitor,
- graphics tablet K 6405, and
- matrix printer K 6314

was used for programming jacquard knitting machines to generate preset patterns. For this, the colored design for the knitting pattern was placed under the camera. It appeared immediately on the color monitor. Using the graphics tablet, the design may then be altered. After certification of the knitting pattern, it is stored on a diskette; simultaneously, the program for the jacquard knitting machine is derived from the certified image and is likewise stored on diskette. This diskette then controls the jacquard knitting machine.

Mini Image Processing System

The mini image processing system based on the EC 1834 is described in detail on pages 93 through 96 of this volume.

HOSTESS II Hotel Project

This project transmits a solution checked on the A 5120 office computer to an EC 1834 with a K 6316 printer. The system simplifies reception through rationalization of room reservations or assignments, management of guest records, and automation of preparation of guest statements.

P 8000 Compact Programming and Development System

Compared to the larger previous model P 8000, a 50-percent reduction in the size of the entire system was achieved. The software of the P 8000 is also usable without limitations. The P 8000 compact system is used primarily for program development for various microcomputer systems.

Robotron A 7150 Workstation as a Telex Terminal

With an additional card and the Gepard-16 Telex software, the A 7150 may be connected directly to the worldwide Telex network. The cards and program are developments of the Hungarian firm Triton.

In addition to its other uses, the A 7150 can then perform all the functions of a teleprinter in background operation. Normal text files may also be transmitted and are automatically adapted to the character set and the text configuration of the Telex network.

Arabic and Chinese Word Processing With the EC 1834

In addition to electronic typewriters with Arabic or interchangeable Arabic/English keyboards, now Arabic or Chinese texts can be processed on the EC 1834. And additional device is required for Chinese texts.

New Small Electronic Typewriters

The Erika S 3004 small electronic typewriter line has been enhanced with two additional models:

- Erika S 3005 with (in addition to the Erika S 3004) 500-character correction memory, 500-character constant memory, divisible into two segments, WORD-OUT correction, MODE key for user-friendly functions and constant memory, automatic carriage return, horizontal and decimal tabs, indentation, centering, right-justification, bolding, automatic underlining.
- Erika S 3006 with (in addition to the Erika S 3005) 16-character display, 8-Kbyte internal text memory, correction memory of one A4 page, and variable spacing.

All three models of this series have a 100-character typing wheel in a drop-in cassette as well as (as a special accessory) an interface box with COMMODORE/CENTRONICS or V.24 interfaces which provide for connection to computers as letter quality printers.

MR 6090 Electronic Pocket Computer

The MR 6090 from VEB Microelectronics Combine is an enhancement of the MR 609 scientific-technical pocket computer with the following additional functions or improvements:

- conversion of degrees, minutes, and seconds into decimal degrees, minutes, and seconds and vice versa,
- larger, angled displays,
- all sliding switches have been replaced by keys.

"Student" Drafting System for Schools and Professional Training

This newly developed small drafting system can be dismantled and offers

- A1 paper format,
- carriage plotter,
- plotting head, lockable and clampable every 15 degrees, clampable square,
- drafting table of steel tubing construction,
- 700-mm x 1,200-mm drawing board,
- incline adjustment by spring action,
- angular adjustment of the drawing board from 0 to 70 degrees with stops.

Bibliography

1. Dr Joachim Richter and Dietmar Schier, "Status and Continuation of Basic Software Development for ROLANET1," NEUE TECHNIK IM BURO, Vol. 33 (1989), No. 4, pp 100-103.

2. Rolf Hallensleben, "Robotron A 5240 Time and Access Control System for Efficient Time Recording and Access Control," NEUE TECHNIK IM BURO, Vol. 32 (1988), No. 2, pp 56-58.

FACTORY AUTOMATION, ROBOTICS

GDR: Robotized Printed Circuit Installation Technique Developed

23020073p East Berlin FEINGERAETETECHNIK in GermanNo 5 1989 p 192

[Text]A new industrial robotic device from the Weimar-based Efficiency Measures Enterprise of the ROBOTRON Combine makes possible the transition from manual to automatic mounting of printed circuits in small- and medium-sized serial runs. This innovation, first exhibited in Leipzig in 1988, is the first of its kind in the GDR. The device can be used for automatically fitting circuitry and other microelectronic components into flexible assembly cells. The corresponding software, developed in collaboration with the Technical College at Ilmenau and the Friedrich-Schiller University in Jena, substantially minimizes the device's attendant retooling costs and insures automatic error diagnosis. The device has been touted as capable of increasing printed circuit production by 170 percent.

TELECOMMUNICATIONS R&D

State of Hungarian Telecommunications Development Reviewed

24020024 Prague PTT REVUE in Czech Mar-Apr 89 pp 44-47

[Article by Boris Kubin, ScC, Communications Research Institute, Prague: "Current Developments in Hungarian Telecommunications"]

[Text] For Czechoslovak communications specialists, a visit in the Hungarian People's Republic may become a source of information, especially because the Hungarian administration of communications holds the leading position among socialist countries in introducing new telecommunications services. Moreover, Hungarian ideas about overcoming the underdevelopment of the telephone network are also interesting.

The Situation of Standard Telecommunications Services

The primary and most far-reaching task of Hungarian telecommunications calls for improvement of telephone services and above all, for overcoming their underdevelopment. The density of 17 main telephone stations per 100 residents (the situation as of early 1988) has not come even midway the European average, and on the scale of the socialist countries, it ranks behind the CSSR, GDR and the Bulgarian People's Republic.

Part of main telephone stations are still connected with manual exchanges[1]; some of them are still in the local battery system (see Table 1). The number of main telephone stations is increasing annually by approximately 50,000. The number of pending applications for the installation of a telephone line amounts to almost 500,000. Part of long-distance telephone operations (toll and international calls) come from subscribers connected to manual exchanges (see Table 2).

Subscribers to telecommunication services in Budapest have certain advantages over those who live in the rest of the country (in the Hungarian language, they are called country "videki"). Thus, for example, at the beginning of 1987, 91.1 percent Budapestians had access to long-distance telephone connection, as compared with only 72.1 percent outside Budapest. With its 2 million residents, Budapest had 49 percent of all telephone stations and the rest of Hungary (8.6 million citizens) 51 percent.

The wire and teletype network is part of the Hungarian integrated teletype and data network; 949 teletype machines in 316 pooling telegraph stations were added to it in the beginning of 1987. In 1986, 12,365,968 telegrams were dispatched and 4,891,354 of them were delivered on ornamental blanks.

At the beginning of 1987, the teletype network (fully automated) included 11,500 subscriber stations; requests for the installation of teletype stations were equal to about 10 percent of the already operating ones. Since the NEDIX 510 integrated teletype and data exchange (supplied by the Japanese NEC Company) began to operate in Budapest, subscribers to telex could participate in automatic international connections with 166 countries in the world.

Table 1. Development of the Number of Connected Main Telephone Stations in the Hungarian People's Republic

Year	With automatic exchange	UB	MB	Total	Percent of connections with automatic exchange
1981	556,626	46,826	33,173	636,625	87.4
1983	597,395	46,614	32,375	676,384	88.3
1985	661,546	47,067	30,187	738,800	89.5
1987	739,834	45,100	27,808	812,748	91.0

Strategy for Development[2]

Approximately 17,000 persons are employed by the Hungarian telecommunications base. The volume of capital assets of telecommunications amounts to Forint 42 billion (the rate of exchange is approximately 2 Ft = Kcs 1), most of them in the telephone network. In addition to about 1.5 million service lines of the master telephone station, there are 2,150 exchanges (state) and 13,000 extension lines. Private telephones represent 34 percent, those of organizations, enterprises and institutions 64 percent, and public telephones 2 percent. About 5 percent of the telephones in 1,800 Hungarian villages are serviced by operators; only essential lines have continuous overnight connections.

A major obstacle to the extension of the telephone network is the shortage of terminal capacities and obsolete telephone exchanges. Thus, for instance, 45 percent telephone exchanges with the rotary system are nearing their phase-out. Hungary launched its production of communications systems of the second generation (BHG) relatively late, in 1980, and the training of additional specialists in this technology is plagued with problems.

Table 2. Quantitative Data on Long-Distance (Toll and International) Telephone Traffic in the Hungarian People's Republic

	Volume of long-distance telephone operations in 1987		
	State-wide	International	Total
Manual operations (minutes)	168,801,041	6,853,612	175,654,653
Automatic operations (impulses)	1,347,458,843	849,928,772	2,197,387,615

Operating throughput of the Hungarian telephone network is low; at peak hours only 46 percent of calls get through (a "good" network should manage more than 60 percent).

For due development of Hungarian economy and for the satisfaction of all demands of that nation, 1.2 million telephone stations should be installed, which together with radical revamping of the telephone network would require investments of Ft 120 billion. In the year 2000 the density should amount to 30.7 stations per 100 citizens. However, the planners consider options with 33 and 41 stations per 100 citizens. However, the planners consider options with 33 and 41 stations per 100 citizens. In 2010 the density should approach its point of saturation with about 75 telephone stations per 100 citizens (current telephone density of Denmark).

Long-range plans estimate the procurement cost of every telephone line at Ft 86,300. The Hungarian telecommunications industry cannot fully renovate and expand the Hungarian telephone network. Necessary imports of equipment cannot be covered by tolerable increases of charges for telecommunications or—in view of the current situation of Hungarian economy—by state subsidies. As the most feasible options are regarded grants of credits from the World Bank—not for direct procurement of the equipment, but rather for manufacturing licences and cooperation.

Sensitive problems concerning the construction and operation of telecommunication systems outside Budapest may be resolved by deregulation, i.e., abolition of monopoly controls. The administration of communications would then limit its tasks to oversight of the compliance with the regulations of cooperation between systems made by different manufacturers. It is envisaged that advantageous conditions for an influx of funds may be created by self-financing in the user sphere.[4]

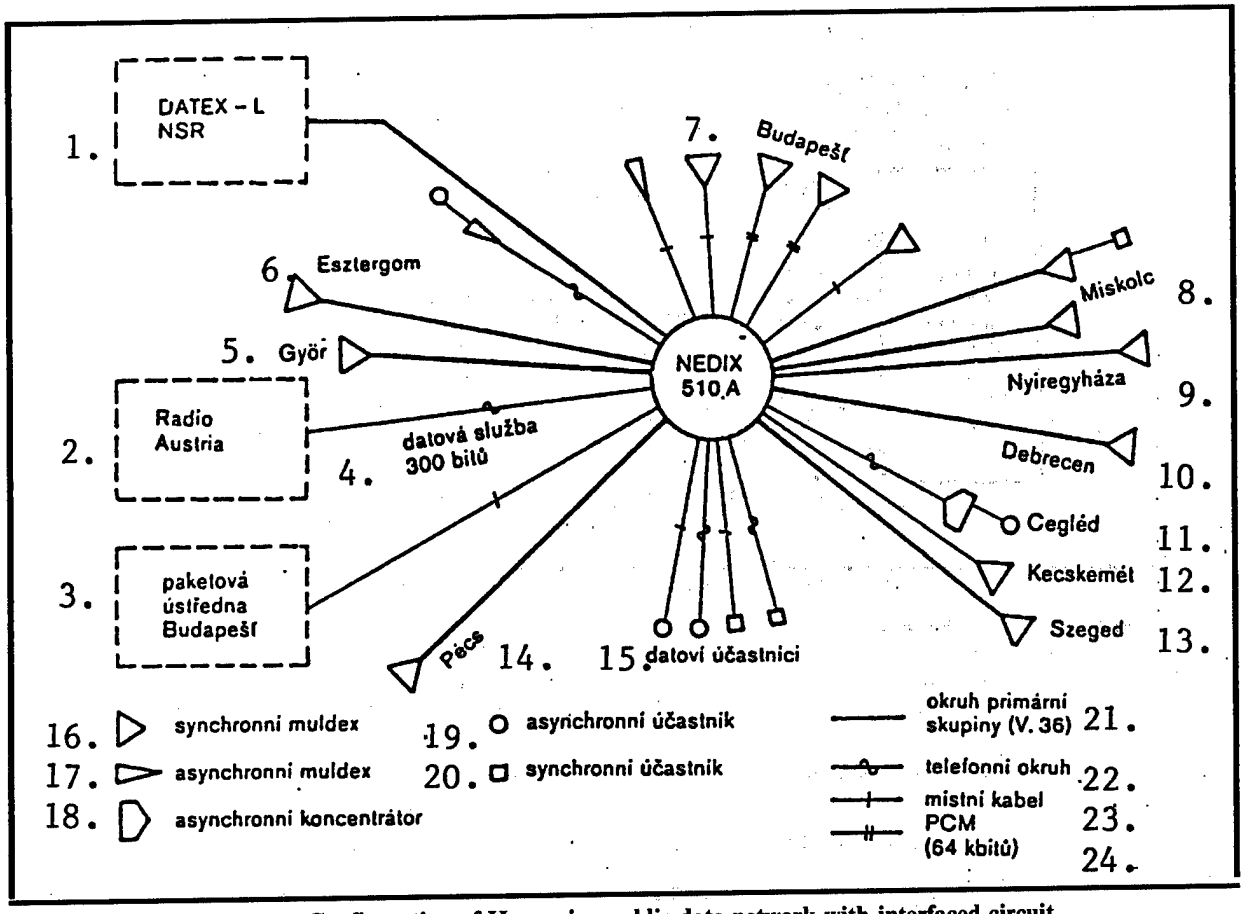


Figure 1. Configuration of Hungarian public data network with interfaced circuit

Key: 1.DATEX-L FRG—2. Radio Austria—3. Budapest packet exchange—4. data service 300 bits—5. [City of] Gyor—6. Esztergom—7. Budapest—8. Miskolc—9. Nyiregyhaza —10.Debrecen—11. Cegled—12. Kecskemet—13. Szeged—14. Pecs —15. data users—16. synchronous muldex —17. asynchronous muldex—18. asynchronous concentrator—19. asynchronous user —20. synchronous user—21. primary group circuit (V.36)—22. telephone circuit—23. local cable PCM—24. (64 bits)

Concepts for Introduction of New Telecommunications Services

Instead of a big lump, which the reconstruction of the telephone network would be, the Hungarian administration of telecommunications does not hesitate to create good opportunities by dealing with "little bits" in the form of improved services of data telecommunications and introduction of new telecommunications services. It argues skillfully and—as it appears—successfully that these services produce immediate benefits not only for the development of national economy but also for the satisfaction of public demands for information, demonstrated, among other things, by steady inroads of personal computers in the Hungarian market.

A practical new method has demonstrated that before the introduction of new services in Hungary it is worthwhile to organize a kind of a prelude in the form of an experimental stage. It proceeds from the awareness that users clamor for extension of new services only after they have gained first-hand experience with them—for example, by participating in an experiment, and furthermore, that the experiment may outline the correct way during the introduction proper of services or definite design of the network.

When dealing with fundamental issues of the development of telecommunications, the Hungarian administration of communications proceeds from the data of its telecommunications research. For that purpose, Scientific Days organized by the Hungarian Research Institute for Communications (PKI - Posta kiserleti intezet) were perfectly timed; their topics included telecommunications, national economy and society[3] with foreign participants (Bulgaria, Finland, France, FRG, USSR, Sweden, Switzerland and Great Britain). Also, international symposia on new services of data communications were organized jointly by the UN Development Program (UNDP), Hungarian Post (the title of the administration

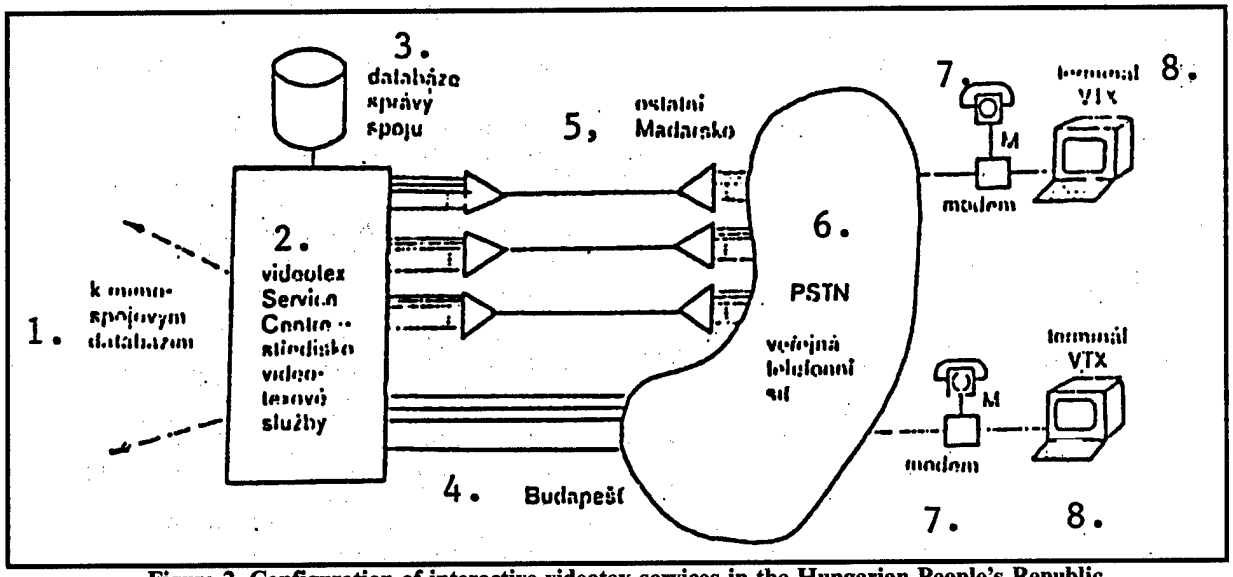


Figure 2. Configuration of interactive videotex services in the Hungarian People's Republic

Key:
1. To non-communications database
2. Videotex Service Center
3. Database of the communications administration
4. Budapest
5. the rest of Hungary
6. PSTN - public telephone network
7. modem
8. VTX terminal

User class	Data signaling rate and format of symbols	Control signals bit/s	Control signals format of symbols	Control signals format of codes
1	300 11 a*)	300	11 a	MA 5
2	110 11 a	110	11 a	MA 5
3	200 11 a	200	11 a	MA 5
4	2400	2400		MA 5
5	4800	4800		MA 5

*) a = unit interval

User class of services in the Hungarian publiuc data network with packet switching.

of communications of the Hungarian People's Republic) and the international telecommunications union. They were held from 12 to 22 April 1988.

These actions signal the breakthrough after a long isolation from countries with advanced telecommunications. We should add the preparations by the Hungarian administration of communications for its entry in the European Commission for Posts and Telecommunications (CEPT), in which West European administrations of communications are associated for the purpose of dealing with matters of cooperation in the area of telecommunications (among other things, also with the most advantageous application of individual recommendations of the CCITT in the conditions of Europe).

Public Data Networks in the Hungarian People's Republic

Its basis consists of a public data network with circuit switching (commutation VDS) with a single exchange in Budapest and with a muldex system (muldex is multiplexor and demultiplexor) which form in one fast digital circuit a greater number of digital circuits at a slower speed (or lower rate) and one asynchronous concentrator (next to the multidex function, it also takes over some functions of the exchange), see Figure 1. The system which serves also the telex and public telegraph has been in operation since 1981. A public data network with packet switching (packet VDS) is scheduled to begin operation in 1990 or 1991 and then both networks will be interfaced. The network has access to the FRG and Austria.

Table 3 presents a scheme of user categories made by the commutation public data network. Subscribers (owners of connected terminal data equipment, i.e., computers and terminals) are offered the following users' options: direct calls (no dialing); closed user group; closed user group with outgoing access; with barred outgoing calls; identification of the calling line; barred incoming calls; failure logging of inactive terminal data equipment, and search for free line (for extension group).

The NEDIX 50 communications system is based on the principle of addressed transmission of patterns through memory, which forms the switching network of the exchange. Transmission for asynchronous categories is transparent, i.e., it transmits a sufficient number of patterns of bistable digital signal for telegraphic distortions to remain within acceptable limits. Synchronous categories use a method which is nontransparent in terms of modulation rate, but which is compact in terms of the number of patterns per unit interval.

In 1990 the commutation VDS will be expanded by another exchange in Budapest (probably by Siemens

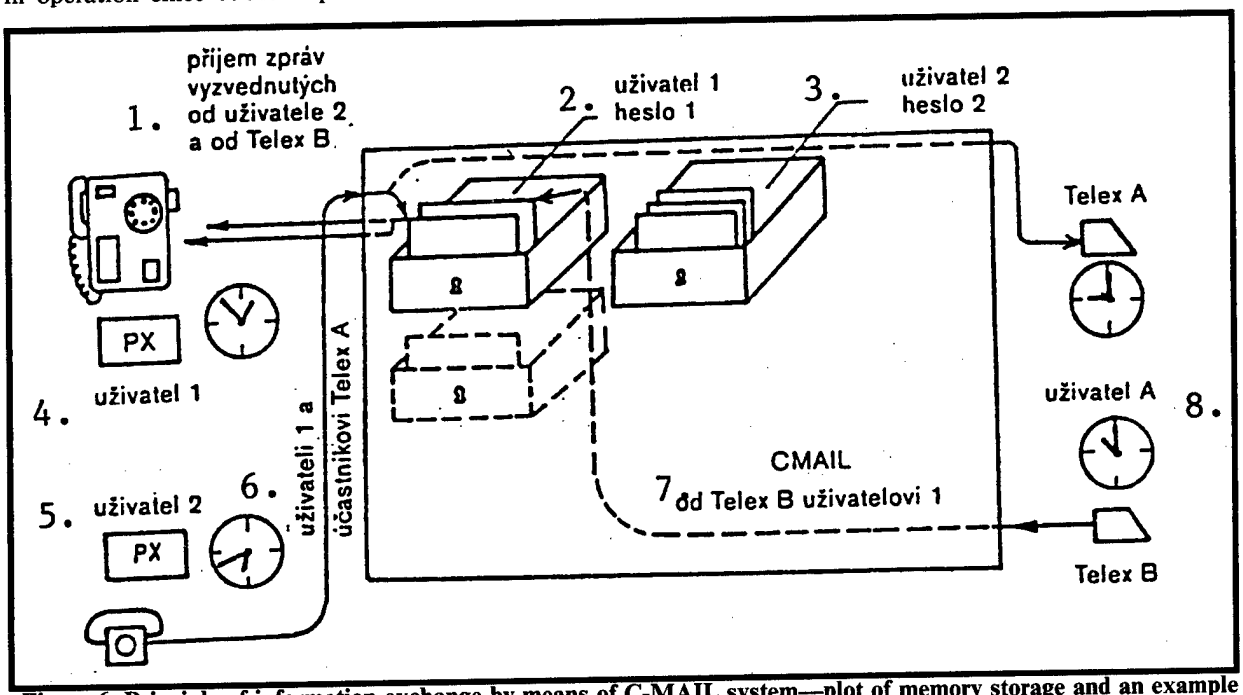


Figure 6. Principle of information exchange by means of C-MAIL system—plot of memory storage and an example of transmission of information from user 2 to user 1 and to teletype subscriber Telex A; furthermore, transmission of information by teletype subscribers Telex B to user 1.

Key:
1. Reception of information collected from user 2 and from Telex B 2. User 1 Password 1 3. User 2 Password 2 4. User 1 5. User 2 6. To user 1 and Telex A subscriber 7. C-MAIL from Telex B to user 1 8. User A

Company) and by one outside Budapest. Long-range plants project a network with five exchanges.

Introduction of Videotex Service

Hungarian interactive videotex services began a test run in the building of the central telegraph office in Budapest. A view of its applied system is presented in Figure 2. This system permits telephone subscribers, who will be furnished with a special terminal (TVX), to communicate by means of the telephone network with the database of the administration of communications, in which various suppliers will provide information also by means of VTX terminals (Figure 3 [omitted]). In the future the system will be expanded with a database of non-interlinked organizations. Toll digital transmission is not made over the telephone network, but rather over a muldex system. In late 1988 about 120 subscribers had already installed this system.

Figure 4 [omitted] offers an example of allocation of optional user-specific graphic symbols, and Figure 5 [omitted] shows their application as illustrations in sections of railroad timetables.

System of Exchange of C-MAIL Information

The Hungarian administration of communications introduced on experimental basis a special information system whose principle is presented in Figure 6. The core of the system is the computer whose storage areas are allocated to individual subscribers. By means of his PX portable pocket terminal the user may store in them data entered with a password, so that another designated subscriber may retrieve them. The system includes also subscribers of the telex network.

Pocket terminal (Figure 7 [omitted]) is connected to any telephone by acoustical coupling. About 40 PX terminals have been thus far on loan to selected users involved in the experiment.

Bibliography

1. Lipp, J., and Sergyanne, R. J., "Tavforgalmi mennyl-segi adatok," (Quantitative Data on Telecommunication Operations), POSTA 1987, No 12, pp 14 and 15.

2. Toth, I., and Doros, B., "A fejlesztes strategiaja" (Strategy of Development), POSTA 1987, No 12, pp 1-5.

3. Scientific Days'88 of the Research Institute of the Hungarian Institute of Posts and Telecommunications Institute: Telecommunications, Economy, Society, Budapest, PKI 1988.

4. Hochman, R., Kubin, B., and Sramek, J., "Research, Planning and Installation of Telematic Services," Travel report on VTS-Hungarian People's Republic, 1 February 1988, December 1988.